Gas Journal

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Editorial Notes

Flueless Heating

On later pages we publish the findings of the Medical Advisory Committee appointed by the President of the Royal College of Physicians, Lord Dawson of Penn, at the request of the Governor of the Gas Light and Coke Company, to consider problems arising out of modern developments in the use of gas for domestic heating and of changes in methods of building construction, with special reference to the significance to health and comfort of the use of flueless gas appliances in rooms unprovided with flues or other devices which promote ventilation. The document carries the stamp of the highest authority and is of the greatest importance to the Gas Industry and the general public, though it has been a source of annoyance to the electricity industry. As Lord Dawson says in a foreword, the matter concerns the health of the people, and in such a question it is the duty of the Royal College of Physicians " to point the way and to give such unbiased and independent opinion as, perhaps better than any other body, it is in a position to do." The Committee published an interim report in August of 1935, which we gave in the " Journal " for Aug. 14 of that year. It will be remembered that one of the conclusions put forward in that report was that, with correct gas rate—and this, of course, is all-important—flueless gas heaters can be employed with absolute safety in rooms not provided with a flue. " Any risk to health from the inhalation of products of combustion from flueless gas heaters," it stated, " is discounted by the fact that, even with an air change as low as one per hour, discomfort from overheating would be experienced long before harmful concentrations of such products would be reached."

In its final report the Committee considers in detail fundamental problems and commonly accepted data in regard to ventilation, warmth, comfort, and the effects, if any, upon health of the products of combustion of town gas. The report is presented with remarkable clarity and the reasoning throughout will prove of help in dispelling many a faulty conception. The Committee remarks that there is no general agreement as to what constitutes sufficient ventilation in a room unprovided with a flue and dependent entirely on the opening of windows and doors for the entrance of fresh air and the escape of foul. " In the public interest it is highly desirable that this problem should be studied without delay, and, until there is evidence forthcoming that satisfactory ventilation can be otherwise obtained, the Committee is of opinion that, wherever possible, living rooms and bedrooms should be provided with flues." The flueless room is a bad thing for the public, and this doctrine should be preached until the building industry is forced to provide only dwellings with adequate ventilation. There is at present uncertainty as to whether the provision of an air brick appreciably increases the ventilation of a flueless room. In flueless rooms of less than 1,000 cu.ft. capacity an air change of more than one per hour is commonly found, while in larger flueless rooms the air change may fall as low as $\frac{3}{4}$ or less per hour.

Gas Rate and Room Capacity

In the interim report the Committee suggested a maximum gas rate of 1 cu.ft. per 50 cu.ft. of space in a flueless room—this for intermittent use. For average conditions an allowance of 1 cu.ft. of gas per 100 cu.ft. of room capacity would be sufficient to maintain comfort if the gas heater were in continuous operation. In the final report the Committee discusses in detail this vital question of gas rate, the effects of the various products of combustion being set out step by step. First in regard to water vapour, under normal conditions the foregoing rates would not lead to a significantly high humidity.Then as to carbon dioxide. Even with a minimum air change and under such conditions of vitiation and overheating as would result from a continuous gas rate of 1 cu.ft. per 50 cu.ft. of room capacity, the maximum carbon dioxide concentration would only be about 1%—a concentration having no physiological significance and no ill-effect on the combustion of gas appliances.

Carbon monoxide is considered in much detail, and this section of the report throws light on a matter concerning which there are many misconceptions. Here attention is devoted to what has been described as " chronic carbon monoxide poisoning "—defined in the report as " a condition of ill-health due to exposure at repeated intervals to a concentration of carbon mon-

oxide less than can give rise to acute poisoning even on prolonged continuous exposure." After sifting all the available evidence, the Committee has come to the conclusion that, " while exposure to carbon monoxide, even in very small quantities, may be capable of causing disagreeable effects at any rate in some people during the period of exposure, the available evidence is unconvincing as to the occurrence of any definite group of symptoms which would indicate a chronic form of carbon monoxide poisoning. This view is further supported by the recognized physiological fact that this gas is not stored in the tissues and is therefore not a cumulative poison in the usual medical sense of the term." The Committee states that a concentration of 0·005% of carbon monoxide in the air of a living room would be innocuous and that it might with safety be as high as 0·01%. As a matter of fact, if coal gas is burnt in an appliance of good design combustion is practically complete and the percentage of carbon monoxide in the products of combustion before dilution with room air is less than 0·01%. As to oxides of nitrogen, even with as high a carbon dioxide percentage as 1, which would only be reached under conditions of minimum air change and gross overheating, the concentrations of nitrogen oxides would be approximately one-quarter of the percentage allowable for prolonged exposure.

Sulphur and Future Development

Commenting on the Committee's interim report in August of 1935 we remarked that the report showed that the economy of gas heating can be enjoyed without qualm in rooms not provided with flues. At the same time, we said, the Gas Industry must increase rather than slacken its efforts to ensure that combustion is perfect in every appliance installed, and that no mean consideration in this regard is the still further reduction in the amount of sulphur compounds in the gas supplied. The truth of our contention is well brought out in the Committee's final report now under review. Gas appliances of identical design and operated at the same gas rates will, of course, produce widely different quantities of sulphur oxides according to the gas supplied, and this fact makes it necessary to specify the sulphur content of the gas as well as the size of the room and the air change in any recommendation regarding the possible gas rates for flueless appliances. The Committee has come to the conclusion that the chief importance of the sulphur oxides is their objectionable smell and not their effect upon health; and it recommends as a desirable limit for the concentration of the combined oxides of sulphur, sulphur dioxide and sulphur trioxide, a figure of 0·0001%, at which level these oxides are still imperceptible to smell. This will allow a wide margin of safety because, when this limit is ensured by adjustment of the gas rate of the appliance and the air change in the room, the concentrations of carbon monoxide and the oxides of nitrogen will be insignificant. Appropriate gas rates for gas of varying sulphur content are given in the report, and we would specially call the attention of our readers to these figures. In a room of 500 cu.ft. capacity and 1½ air changes per hour 9 cu.ft. per hour of a gas containing 10 grains of sulphur per 100 cu.ft. can be burned satisfactorily continuously. On the other hand, should the gas contain 30 grains of sulphur per 100 cu.ft., the satisfactory consumption is limited to 3 cu.ft. per hour. These figures are doubled for intermittent use. No better pointer could be given to the need for reducing the sulphur content of town gas to a minimum. It is the sulphur content which imposes a limit on the application of gas for heating in flueless appliances. The development of this important load will be in inverse proportion to the sulphur content of the gas supplied. The validity of the " Sulphur must go " slogan was never brought out more clearly.

The final report of the Advisory Committee of the Royal College of Physicians will prove of benefit to the whole Gas Industry, and thanks are due to Sir David Milne-Watson for requesting Lord Dawson of Penn to assist in elucidating the problem of flueless heating by gas.

Reducing Smoke

In collaboration with the Gas Light and Coke Company, the Coal-burning Appliance Makers' Association and the Coal Utilisation Council have produced a smoke-reducing coal fire. This new fire was demonstrated in London last week, and it is of considerable interest to the Gas Industry. The fire incorporates a concealed gas supply pipe which is led vertically behind one side of the firebrick of the fire. A small hole is cut in the firebrick for the burner, which has an orifice ⅛ in. in diameter, is situated about 6 in. above the grid and 2 or 3 in. from the face of the grate. It is inclined at an angle of 40° to the horizontal, and the gas flame, 15 in. in length, strikes the grate base at about its centre. After coal has been placed on the fire, a turn of the gas tap automatically ignites the gas at the burner, and the flame resulting from a gas consumption of 50 cu.ft. an hour plays upon the coal. The gas stream has a high velocity—160 ft. per second at the orifice—and produces much turbulence and an indefinite zone of combustion. From the moment of lighting the fire presents a cheerful appearance due to the luminous flames playing on the coal, and an appreciable radiation is obtained during the ignition stage, which is a matter of 15 minutes. During this period there is no smoke, for the volatile matter evolved from the coal is ignited by the gas. The gas flame ensures a good flue draught.

That, in bold outline, is this new fire, the result of a joint effort of the Gas Industry and the coal industry. We have before us a report of an investigation carried out on the coal ignition by the Fuel Research Board. The tests made showed a reduction of the total smoke emitted of 24% with a caking coal and 52% with a non-caking coal. In general terms, then, the application of gas in this way for the ignition of coal fires would mean a reduction of domestic smoke of anything from a quarter to a half. This should appeal to any housing authority, and, indeed, to all who are public-spirited. To the householder and housewife the new fire must have appeal from the fact that all the added convenience of a coal fire, so to speak, " on tap " can be enjoyed without adding to the weekly budget, for the cost of the gas is no more than the cost of firewood ordinarily used for lighting the coal fire. The fire, though admittedly a compromise—the ideal at which to aim is smokeless fuel—should, finally, appeal to the Gas Industry, since it obviously implies a substantial additional gas load.

Competition from Coal

In its intense effort to combat the competition of oil and natural gas, the American coal trade is taking the highly creditable stand that it must rely upon its own efforts. These efforts are directed towards giving the consumer what he wants, and in some instances discovering what the consumer would like a year or two in advance of that individual's own realization of the fact. The coal is being sized, it is being cleaned, it is being graded so that the quality and nature of the material provided shall suit customers' appliances, it is being blended for the same purpose, it is being done up into clean packages which can be placed one at a time on the fire and which, when the wrapper has burnt away, distribute six compressed blocks of coal evenly over the surface of the fire, and it is being treated for dust-prevention so that a cart-load of coal can be dumped and "got in" during the busiest wash-day without soiling the clothes that are hanging to dry on the line outside. These are the things they do in America. Will the same practices spread to this country? It must not be forgotten that gas is not a competitor of coal, but coal is a competitor of gas. People can burn coal without burning gas; they cannot burn gas without using coal indirectly. It may be, therefore, that the Gas Industry will have to compete also with the coal trade in the future, more especially since the coal interests are doing their best, in collaboration with the Fuel Research Board, to discover a method of rendering the domestic open fire smokeless; the Director of the Coal Utilisation Council has publicly announced that in his view it is far better to make the open coal fire smokeless than to "sacrifice" it by replacing coal with smokeless fuels. That is a direct challenge to the gas fire and the coke fire.

In the list of things just given which the American coal trade is doing to encourage people to use coal in place of other fuels, one has been omitted—it is being made easier to use coal; labour is being eliminated and the fluctuations due to periodic stoking are avoided by the extensive use of the mechanical stoker. It is hard to realize that mechanical stokers are being made, and sold in quantity, of a size small enough to feed less than 20 lb. of coal per hour. We have not yet adopted central heating to anything like the American extent, but it is undoubtedly increasing, and particularly in our larger towns. There is as yet no market for these special appliances here, but the speeches at the Illinois University course, to which we referred in these columns last week, show how vitally important these things have become in the American fuel market. The British coal industry is now fully awake to the need for a forward sales policy—using the term "sales" in its widest sense—and unquestionably anything that is dedeveloped in other countries which might assist the coal salesman here will be exploited.

Coke Quality

It is interesting to note how many of the well-known practices of the Gas Industry are being copied by the American coal trade. As examples, it may be mentioned that one of the Illinois Papers advocates the extensive employment of "fuel engineers" by collieries and by coal merchants. It is intended that these shall be exclusively technical men who shall give technical service to coal buyers and shall deal on the technical side with complaints, besides advising the consumer what kind of coal and appliance he should have. The American coal merchant is selling coal-burning appliances, as well as fuel. And, as a last example, one Paper declares that ". . . the retail coal merchant must interest himself in every phase of heating, and he must be in a position really to serve the householder," the service being defined in terms of sales, delivery of coal, cleaning and repairing the coal-burning appliances and furnaces, or "sell or rent and install automatic burning equipment or what not." When we come to think of it, our Gas Industry is well to the fore even when measured by the standards of American salesmanship. But that is no reason for not doing still more.

Should we render our coke dustless? In America it is treated with calcium chloride, calcium chloride mixed with other chemicals, with emulsified oils, or with straight oils. The calcium salts may improve the combustion properties, and the oil would improve the calorific value, though possibly with deterioration as regards smoke production, both would obviate any dust nuisance, and that is a matter of considerable importance, as anyone can testify who has stored a ton of coke in a dry outhouse through the summer and has had the task of filling it into the coke-scuttle for use in the house. An important advantage claimed for dust-treated coal is the reduction of flying ash particles and fine combustible matter, coupled with more complete combustion, and no doubt the same effects would be observable with dustless coke. Unquestionably coke could be improved for the open grate in particular if the light pulverulent ash now produced could be replaced by larger particles that would not block the draught and that would not fly about the room when the fire was poked. It should not be difficult to devise a dust-treatment process that would prevent dust in storage and when handling and also coagulate the ash to avoid the difficulties just named. That might mean that the substances used for dust-prevention would have to be selected to suit the analysis of the ash, but that would not necessarily be an insuperable objection to the suggestion. This possibility would, of course, be considered in conjunction with the sodium carbonate-lime activation system to which reference has lately been made in these columns.

Trade Prosperity

Figures published a few days ago show that foreign trade—chief index to the country's prosperity—recorded a remarkable rise last month, and the year 1936 closed with the highest imports since 1931, while it is necessary to go back a year further still to find better export totals. As compared with the previous year imports were greater in 1936 by nearly £93,000,000, and exports (including re-exports) by no less than £20,000,000, which goes to support the theory that improvement at home is no deterrent to the re-establishment of overseas trade.

From these figures it would appear that the adverse balance of trade has largely increased—a state of affairs which may, perhaps, give rise to some misgivings. It is likely, however, that a large proportion of this difference will be counterbalanced by "invisible exports." Increased trade calls for additional shipping; freights have shown an upward tendency; and finance has been provided for increased business generally. These factors, together with the greater return from foreign investments, all have an important bearing upon the difference between the official figures of imports and exports.

A glance at some of the principal items affected by

the Government's re-armament policy and greater manufacturing activity elsewhere will show conclusively that a considerable percentage of the increased imports will pass into factories or become involved in processes in which gas plays a prominent part in the production of the finished article. Again, the chief items of export tell a similar story. For instance, exports of pottery increased by £358,896; electrical goods by £489,398; machinery by £1,830,981; apparel by £804,518, and vehicles by £2,802,967. The Gas Industry is well aware of the important extent to which our primary product is employed in all these industries; indeed, in not a few of them it is the controlling factor in efficient and economical output. Moreover, the fact that imports are in excess of exports may be interpreted as evidence of the capacity of home markets to absorb their own goods in increasing measure. And this, in turn, is reflected in the greater spending power of the community.

In short, there is every indication, as we have pointed out, of outstanding opportunity for the Industry in the year which lies before us. Increased imports of raw materials and exports of finished products provide scope for extending our industrial load still further; while the resulting prosperity—which places more money in the pockets of the people—gives the domestic salesman his chance of increasing the use of gas in the home, each market being dependent upon the progressing policies of individual gas undertakings in sales service and scientific tariffs. The one danger to be avoided is any false sense of security or feeling that we can sit back and wait for increased orders to flow in. Greater spending power frequently gives people the idea that they can indulge in more expensive fuels and less economical or reliable processes which operate under the guise of "the latest thing." The Gas Industry will obviously best profit from the opportunities offering by the prosecution of intensive selling effort and in preparing itself to meet the increased demand in the most efficient manner.

PERSONAL

The Grand Council of the Federation has unanimously approved the nomination of Lord HIRST for the office of President of the F.B.I. for another year.

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The retirement of Mr. HERBERT COLDRIDGE HIGGS from the position of Managing Director and Secretary of the Basingstoke Gas Company took place on Dec. 31. It was in November last that the majority of the ordinary stock of the Basingstoke Gas Company was acquired by purchase from the stockholders by Associated Utilities, Ltd., a subsidiary holding company of Mid-Southern Utilities, Aldershot. An interesting ceremony took place in the Board Room at the Church Street Offices of the Basingstoke Gas Company on Jan. 7, when Mr. Higgs was the recipient of a presentation from his former fellow Directors of the Company.

Mr. William J. Bird, the late Chairman of the Basingstoke Gas Company, who presided, said he had been a member of the Board of Directors for over 26 years, and Chairman for over 14 years, and his association with the late Mr. William Higgs, who was chief executive officer of the Company during the earlier portion of that period, and afterwards with Mr. H. C. Higgs, his son, who succeeded him, had been of the pleasantest possible description. While his father, the late Mr. William Higgs, was acting as Secretary and Engineer, Mr. H. C. Higgs was appointed Works Manager in September, 1918, and in December, 1923, he was appointed Manager and Assistant Secretary. On the retirement of Mr. William Higgs in August, 1926, he was appointed Secretary and Engineer, and in September, 1930, he was elected to a seat on the Board of Directors and was appointed Managing Director. The valuable services which Mr. Higgs had rendered were reflected by the steady progress and development of the Company and the strength of its financial position. On behalf of his fellow Directors, he then presented Mr. Higgs with a silver rose bowl mounted on an ebony plinth, as a token of their esteem and regard and in memory of many happy years of association together. The rose bowl bore the following inscription:

> Presented to Herbert Coldridge Higgs, Esq., M.Inst. Gas E., by his fellow Directors of the Basingstoke Gas Company on his retirement as Managing Director and Secretary. December, 1936.

Mr. Higgs, in returning thanks, said he should greatly value this gift, which would always remind him of the many years during which he had served the Company and also of his long associations with his fellow Directors. His father had set a very high standard of service, and he had endeavoured to maintain that high tradition.

On the previous Wednesday Mr. Higgs was the recipient of another presentation, which took the form of a silver cigarette case, suitably engraved, from the staff and employees of the Company.

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The resignation of Mr. D. D. BURNS, Secretary and Treasurer of the Glasgow Corporation Gas Department, is announced. He has been appointed Secretary to Birmingham Corporation Water Department in succession to Mr. J. H. Broadley, who retires in May. Mr. Burns, who is 37 years of age, joined the Glasgow Water Department staff after the war and rose to become Assistant Accountant. A little over a year ago he was appointed Secretary and Treasurer of the Gas Department.

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After 46 years in the Gas Industry, the past twenty of which as Manager of the Rothwell Gas Light Company, Mr. LEWIS SHAW retired at the end of December last.

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Mr. J. MARTIN, Robin Hood's Bay, Yorkshire, has been appointed Manager of Ayton Gas-Works in succession to Mr. G. D. Cowie, whose appointment with the Crook (Co. Durham) Gas Company was announced last week.

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Mr. J. N. DOUGHTY, Second Assistant to the Sheffield Gas Company, was on Friday, Jan. 15, appointed Chemist to the Gas Department by the Dundee Town Council. He is a Bachelor of Science of Sheffield University, and has held his present office there for the past nine years.

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We learn that Mr. WILLIAM R. BRANSON, M.Sc., A.M.I.C.E., A.M.Inst.Gas E., has been appointed by the Directors of the Cardiff Gas Light and Coke Company as Engineering Assistant and will take up his duties in March. Mr. Branson was awarded his graduate B.Sc. at Leeds University in 1926 and honours in 1927. He later obtained his M.Sc. degree at Leeds University with a thesis on "Carbonization of Weathered Coal." His early gas-works training was secured at Newcastle, and subsequently after a short period at Hartlepool, he was appointed Pupil Engineer with the Gas Light and Coke Company.

"Gas Journal" Shewring Fund

We are now able to publish a report upon the accounts by Messrs. Donovan Whitehouse & Co., Chartered Accountants, who were good enough to consent to act as Hon. Auditors to the Fund:

The Editor,
The "GAS JOURNAL."

DEAR SIR,—We have examined the books of the "GAS JOURNAL" Shewring Fund. We hereby certify that at the 1st January, 1937, the sum of £983 18s. 4d. had been received by way of donations to this Fund, which has been applied as follows:

£55 paid to Mrs. Shewring on the authorization of Messrs. F. G. Shaw, W. W. Townsend, and J. Bridge.

Balance paid into a Post Office Savings Account entitled "Shewring Fund" in the names of Messrs. F. G. Shaw, W. W. Townsend, and J. Bridge.

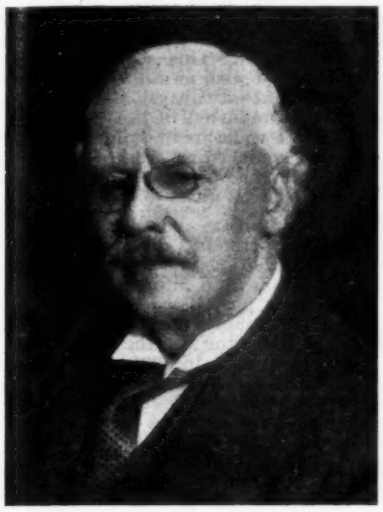
Yours faithfully,
DONOVAN WHITEHOUSE & CO.,
Chartered Accountants,
Honorary Auditors.

26, *Bedford Row, W.C.* 1.
15*th January*, 1937.

OBITUARY

Charles Clare.

His many friends in the Gas Industry will learn with great regret of the death last week, at the age of 73, of Mr. Charles Clare at his home, New Farm, Coombe Bissett, near Salisbury.



Mr. Charles Clare.

Mr. Clare was with Fletcher, Russell, & Co., Ltd., for 44 years, and has been a member of the Board since 1897. For the past thirteen years he was Chairman of Directors of this firm and for a period of fourteen years on the Board of Radiation Ltd.

Mr. Clare will be largely remembered for the prominent part he played in the formation of the Society of British Gas Industries, and his passing will be felt with a deep sense of personal loss by every member of the Society, in whose ranks he was held in the highest esteem and affection—and more especially by those older members who were associated with him and were able to appreciate his untiring energy and zeal in the early days which followed its inception.

Following proposals for the establishment of an institution of gas-works contractors and manufacturers which were made in the "GAS JOURNAL" towards the close of 1904, several of the firms who were displaying their apparatus at the Earl's Court Exhibition approached Mr. Clare, who was Chairman of the Exhibitors' Committee, with the request that a meeting of that Committee should be held to discuss such a scheme. In the issue of the "JOURNAL" to which we have referred the Earl's Court Exhibition was put forward as an illustration of the community of interest which existed between gas plant contractors, appliance manufacturers, and the makers and suppliers of gas; but there was, we then suggested, another fact that had been impressed with equal force—namely, that the gas-works contractors and appliance manufacturers of this country, intermingled in interest with, yet having a distinct sphere in, the Gas Industry were in an utter state of disorganization. They had no representative, central organization which could speak and act with authority, and form mutually beneficent alliances with kindred institutions. We finally urged that Mr. Clare should call a meeting of the Exhibitors' Committee for the private discussion of this matter.

Such a meeting was duly held, and, as a result of a resolution which it adopted, gas plant, apparatus, and fittings manufacturers throughout the country received an invitation from Mr. Clare to a meeting the following February (1905) to consider the formation of a National body. It is difficult to appreciate now the enormous amount of work that Mr. Clare must have shouldered leading up to the meeting on Nov. 22, 1905—twelve months after the idea was first mooted—at which the Society of British Gas Industries formally came into being. And it was a fitting acknowledgment of his long and painstaking efforts in connection with the organization of the Society that Mr. Clare was unanimously elected first Chairman of the Council. For the first four critical years Mr. Clare occupied the Chair, and it was mainly due to his enthusiasm and faith in the future that the Society was held together through all manner of difficulties, and the sure foundations were laid of the successful body as it exists to-day.

In 1910 Mr. Clare relinquished the Chair in favour of Mr. F. J. West, but he continued to be a staunch supporter of the Society throughout its history, occupying for several years the position of Hon. Treasurer, which appointment he resigned in 1927. It was appropriate that at the Thirteenth Anniversary Meeting of the Society, held on Nov. 7, 1935, Mr. Clare should, in the absence of the President, have led their deliberations from the Chair, and many well-deserved tributes were paid to him on that occasion. Of these we cannot do better, in summing up a life's work for the Gas Industry, than quote the words of Mr. E. J. Fox, who proposed a vote of thanks to him. "Mr. Clare," he observed, "has set an example not only in regard to the high standards of his business transactions, but also in the principles he has always set himself to follow throughout his career. It is a matter for great gratification to feel that the S.B.G.I. has this example to follow."

Mr. Clare was a keen Freemason, being a P.M. of the "Summum Bonum" Lodge, No. 3655, of which he was one of the founders in 1913, and also of the Evening Star Lodge, No. 1719. At a meeting of the Provincial Grand Lodge of Middlesex in June, 1928, he was appointed a Grand Standard Bearer by His Majesty the King, who, as the Duke of York, was at the time Provincial Grand Master.

Mr. Clare was laid to rest on Friday in the old Churchyard at Coombe Bissett in the presence of many of his friends. Mr. L. P. Potter, a Director, represented Radiation Ltd. Mr. J. H. Kemp (Director and General Manager of Fletcher, Russell, & Co., Ltd.) was unavoidably absent through illness. Mr. A. L. Griffith represented the Society of British Gas Industries.

APPRECIATIONS.

By F. B. Richards, Chairman, Society of British Gas Industries.

The members of the Society will all recall with the greatest pleasure the occasion of our Thirtieth Anniversary in 1935 when we were able to pay tribute to Charles Clare, our Founder. Mr. Clare was perhaps essentially conspicuous for the number of his friends, and his unfailing kindliness was extended to them all. Those who came in contact with him will remember him as a man of gentle disposition and honest purpose, and though we shall now see him no more at the gatherings of the Industry, his memory and our sense of loss will remain.

By Arthur L. Griffith.

As an old friend of 50 years' standing, I should like to pay my tribute to the late Charles Clare. He and I were friends when back in the 'eighties he was in a Bank and I in an Insurance Company, both in Cornhill in the City of London. When he founded the Society of British Gas Industries in 1905, often referred to as "Clare's Baby," he showed his confidence in me in recommending me for the Secretaryship, and we were closely associated together in that way for 30 years, during which his cordial co-operation and support were always most helpful. I know it was a great satisfaction to him to feel that his efforts for the Society were so successful and that before his passing it had firmly established its position in the Gas Industry. He was one of those straightforward and conscientious men whom it was a privilege to know and whose departure leaves a blank among his many friends by whom he was so much esteemed and respected. Of him it can be truly said:

"Life's race well run,
Life's work well done,
Now comes rest."

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Mr. FRED. THORPE, Engineer and Manager of the Borough of Colne Gas Department, passed away on Jan. 11. The interment took place last Thursday at St. Luke's Cemetery, Farnworth, after a short service at his home.

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The death has occurred at the age of 87 of Mr. JOHN CAY, for 27 years Gas Manager at Keith. A native of Aberdeen, he entered the service of Aberdeen Gas Department, and was appointed Manager at Keith in 1889. He retired about 20 years ago. After his retirement he joined the Town Council and became a Magistrate.

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The death occurred on Jan. 12 at Edinburgh of Dr. ALFRED DANIELL, M.A., LL.B., D.Sc., in his 84th year. Dr. Daniell will be chiefly remembered in the Gas Industry as the scientific collaborator, legal adviser, and intimate friend of William Young, of whom he wrote a fine appreciation in 1911 at the request of the North British Association of Gas Managers as a memorial to one of the greatest sons of Scotland and a great benefactor of the industrial life of that country. Dr. Daniell's work is preserved in the "Transactions" of that Association, having also been published in the "JOURNAL" for Sept. 12, 1911.

News in Brief

CURRENT EVENTS IN THE GAS INDUSTRY

A Manager is wanted by the Rhos Gas Company and the Ruabon Water Company. Further particulars will be found in our advertisement columns.

The Name of the Welshpool Lighting and Power Company has, with the approval of the Board of Trade, been changed to the Welshpool Gas Company, Ltd.

Applications for the Position of Chemist to the Gas Department are invited by the Carlisle Corporation at a salary of £250, rising by annual increments of £25 to £300 per annum.

Two Pictures and Two Drawings of the Luton Gas Company's new showrooms, which were described and illustrated in the "JOURNAL" for Oct. 21 last, have been accepted for the Royal Academy Exhibition of British Architecture.

Special Expenditure amounting to £1,350 is to be allocated by the Town Council for the extension and improvement of the street lighting at Leamington, all of which is carried out by gas. A proportion of this sum will be utilized in providing gas lighting for new roads.

A Scheme of Improvements has been adopted by the Bangor Town Council. It is estimated to cost £7,500. The work to be done includes six new retort settings and auxiliary plant, new tower scrubber, renewal of gasholder and Livesey washer tubes, and repairs to exhausters.

Application to the Board of Trade for a Special Order under the Gas Undertakings Acts, 1920 to 1934, is intended to be made by the Llandudno Gas Department. One of the objects of the Order is to extend the limits of supply within which the Department is authorized to supply gas.

Where the Grey Mare Inn once stood the Bury Gas Department have reserved a site for their new showrooms. Although of a different category we feel sure that the comforts the Gas Department will dispense will be quite as welcome and every bit as warming as those formerly provided by "mine host."

British Visitors to the Leipzig Fair are granted special facilities—*e.g.*, fare reductions, free visas, &c.—provided they produce the Official Fair Voucher and Badge, which will also ensure free entrance to the 45 Fair Palaces and Halls in Leipzig. For British visitors the former entrance fee of 7s. 6d. has been reduced to 5s.

The Coke-Oven Gas Supply from the Brancepeth (Co. Durham) Colliery will be available to the Darlington Corporation Gas-Works from Feb. 12. It will be recalled that in a Paper at the Auxiliary Section of the North of England Association ("JOURNAL" for Dec. 9 and 16) Mr. J. F. Lord, of Darlington, gave details of the work entailed in the provision of this coke-oven gas supply.

Mr. W. H. Johns, M.I.Mech.E., Engineer and Manager, the Swansea Gas Light Company, contributed an article on "Gas Service: Home and Industry," to a trade and industrial supplement to the *South Wales Evening Post* for Jan. 15. Mr. Johns states that their efforts to provide real service at Swansea have been well rewarded, for during 1936 the demand for gas appliances reached an unprecedented level.

Damage to the extent of about £50, mainly in destruction of a row of desks, &c., was caused by fire which occurred on the afternoon of Jan. 15 at the offices of Messrs. Clapham Bros., Ltd., Gas Plant Makers, of Long Croft, Keighley. The outbreak was in the general office, and but for a clerk noticing smoke a number of girls working in an upper room might have been trapped. The town's fire brigade quickly had the outbreak extinguished.

A Total Debit Balance of £174,000 has been incurred by the Salford Gas Undertaking, and the subject of a notice of motion by Councillor W. Crookell to the City Council is "that the Light, Heat, and Power Committee should be instructed to enquire into, and report on, the possibility or advisability of disposing of the gas-works undertaking on such terms and conditions as would enable the Corporation to discharge its financial and other obligations relating to it, and provide a fund which would ensure an annual income at least equal to that now paid by the Department for the relief of the City rates."

A Common-Sense Lesson could well be learnt at Dundee, where, during an electricity failure on Jan. 12, the General Post Office had to carry on by candle-light for over three-quarters of an hour until officials were able to switch on an emergency system. This state of affairs—far too common to be regarded with anything but concern—contrasts strongly with that at Grays, Essex, on the night of Friday, Jan. 8. As reported in last week's issue of the "JOURNAL," during a widespread failure involving cinemas, streets, and shops and lasting from 8 a.m. to 10 p.m., the local telephone service was uninterrupted owing to the lighting of the exchange by gas.

Mr. George Wright, Engineer and Manager of the Lincoln Corporation Gas Department, chose as his Presidential Address to the Lincoln Engineering Society on Jan. 15 "Engineering as Applied to Municipal Services." He gave a review of the part played by engineering services in the development and maintenance of some of the municipal undertakings. Referring to the Gas Department, Mr. Wright pointed out that in 1935 it was agreed that gas for industrial furnaces should be at the lowest rate and the industrial load had increased enormously in consequence. The total increase for this year would be approaching 100 million cu.ft., over 15%.

In a Trade Supplement to the *Western Mail* for Jan. 11, Mr. H. D. Madden, M.Inst.C.E., M.I.Mech.E., Engineer and Manager of the Cardiff Gas Light and Coke Company, contributed an article on "Progress in the Use of Gas," in which he drew attention to the great part played by research in the Industry to-day. "Notwithstanding the fact that the Industry has given a public utility service for over 100 years, research has opened great fields of development for the use of town gas." Mr. Madden concluded by pointing out that the Gas Industry was "now recognized as an outstanding example of the value of organization on a national basis."

The New Showrooms, which have been erected by Prestonpans Gas Company, were formally opened at the end of the week by Mrs. Weatherhead, wife of Provost J. Weatherhead, of Cockenzie. It was explained by Mr. Alexander McDonald, Engineer and Manager, who presided, that the object of opening such premises was for the purpose of endeavouring to show how cheap gas was and how it could lighten labour. If people, he said, utilized gas as it should be used they would find it was most efficient and cheap. In the new showrooms they had many up-to-date gas appliances which would prove very economical. The new showrooms have a decorative scheme of light oak panelling with deep frieze.

The Privilege of the Two-Part Tariff has been extended by the Bradford Corporation Gas Department to prepayment meter consumers. Hitherto the tariff was available only to consumers through ordinary meters. Ordinary meter users going on the two-part tariff have for some years been getting gas at 1s. 6d. per 1,000 cu.ft., *plus* standing charges based on rateable value. Prepayment meter users can now obtain gas at 2s. 1d. per 1,000 cu.ft., *plus* standing charges for meter rent. The flat rate charge, still available for consumers who do not feel they would benefit by the two-part tariff, is on the basis of 4s. 4d. per 1,000 cu.ft. The Department's experience, however, has been that the great majority of ordinary consumers have found the two-part tariff beneficial, and it is expected about 5,000 prepayment meter consumers are likely to find it to their advantage.

A Series of Cookery Demonstrations and an Exhibition of modern gas appliances held at the Masonic Hall, Worcester, was given a good send-off on Monday afternoon, Jan. 11, by the Mayor of Worcester, Lady Atkins, who was accompanied by Mr. John Stallard, Director, and Mr. G. P. Mitchell, Engineer and General Manager, of the Worcester New Gas Light Company. Declaring the exhibition open, the Mayor said: "Gas is very clean, economical, and smokeless for cooking and greatly to be recommended. Gas fires are a tremendous joy to us all." Mr. John Stallard commented that there was such a huge demand in Worcester for gas, especially among commercial consumers, that profits which might otherwise go to reducing the charges for gas had to be used to provide extensions to the works in order to cope with it. Gas cookery demonstrations were given by Miss M. K. Gompertz.

Eighty-Two Municipal Houses will be fitted out with gas appliances by the St. Andrews Gas Company, who have received a contract from the Local Town Council. The cost involved is £1,117.

The Extension of the gas supply from Coleraine to Portstewart, a distance of six miles, will be commenced immediately. The Coleraine Urban Council, who own the local Gas Undertaking, have accepted the tender of Messrs. White & Co., Killyleagh, Co. Down, at £4,548 for supplying and laying the high-pressure main from Coleraine to Burnside at Portstewart, and the tender of Messrs. Sayers & Co., Belfast, at £6,857 for supplying and laying the distribution mains in the town.

The Lighting of Saltash streets may in future, after a lapse of ten years, be lighted with gas instead of electricity. Allegations that the electricity company concerned would not put street lights where they wanted them put, and was acting dictatorially, were made by members of the Saltash (East Cornwall) Town Council at their monthly meeting, and a resolution " that it might be profitable to reconsider the present street lighting of the Borough in view of the apparent reluctance of the East Cornwall Electricity Company promptly to carry out the Works and Water Committee's wishes with respect to public lighting; the almost hopeless prospect of obtaining electricity at the cheap rates promised from the ' Grid,' and the great improvements which have taken place in methods of public lighting by gas " was passed. The Saltash Gas and Coke Company will be asked to submit a scheme and estimates.

The Unremunerative Consumer is being tackled by the Stockport Town Council, who have submitted a report on the standby charge of 5s. to consumers of gas whose consumption does not reach a certain figure. This states that the standby charge was only part of the amended scale of charges which benefited 23,381 consumers to the extent of £12,400. Recent experience had shown that the position was being accepted as a reasonable one, as consumers were steadily ordering appliances to enable them to increase their consumption. Alderman Sir Thomas Rowbotham said the Gas Committee could not supply any house with gas without laying down certain plant to supply it, and people should not want a gas supply if they were not prepared to pay for it. They must have a reasonable return for the expenditure involved, and the minimum charge of 5s. meant a very considerable loss to the Gas Committee. The number of people whose consumption of gas did not amount to 5s. a quarter was 74.

Amalgamation and Grouping

Loughborough and Quorn.

It appears that the recent offer of the Loughborough Corporation to buy the Quorn and Mountsorrel Gas Company has been accepted.

It is now learnt that the Leicester Corporation had also made an offer to the Quorn Directors, and that the City Corporation's negotiations had been unsuccessful, their offer having been refused.

The Leicester Gas Committee are of the opinion that any fresh offer above their original figure would not be a reasonable proposition for Leicester.

Severn Valley: Week's Extension of Time Limit for New Ordinary Shares.

A week's extension of the time limit within which applications for new ordinary shares of the Severn Valley Gas Corporation must be received was recently announced by the Corporation, the last day on which shareholders may lodge applications being extended from Monday, Jan. 18, to Monday, Jan. 25, 1937.

Shareholders, who wish to do so, will also be able to renounce their rights to subscribe until the same date. The extension of time refers to the recently announced offer to shareholders of the right to subscribe for new ordinary shares of 22s. per share on the basis of one new share for every four ordinary shares held.

As the current market price of the ordinary shares is 22s. 9d. per share, this right to subscribe constitutes a small bonus to shareholders.

Try All Things Once

The total number of Cardiff consumers who have tried electric cooking and returned to gas was 1,023 at the end of December, 1936.—*Cardiff Gas Review.*

Come to the Fair!

Joint Gas Conference Programme

The Joint Gas Conference, of which preliminary notice has already been circulated, will be held at the British Industries Fair, Castle Bromwich, on Feb. 23 to 25.

The following programme has been arranged:

Tuesday, Feb. 23.

11.15 a.m.	Assembly in the Conference Hall, where the Chair will be taken by the Earl of Dudley, M.C.
11.30 a.m.	Official Welcome to the Members by the Lord Mayor of Birmingham and the President of the Birmingham Chamber of Commerce. Reply by the Earl of Dudley, President of the Conference.
12.0 noon.	Presidential Address by the Earl of Dudley.
1 p.m. for 1.15 p.m.	Official Gas Luncheon in the Bradford Dining Room (adjoining the Conference Hall).
Afternoon.	Inspection of the Exhibits at the Fair.

Wednesday, Feb. 24.

10.15 a.m.	Assembly in the Conference Hall.
10.30 a.m.	Display of Gas Publicity Films
Afternoon.	Inspection of the Exhibits at the Fair.

Thursday, Feb. 25.

This day in the proceedings has been left open to provide members with a further opportunity for the inspection of the exhibits at the Fair.

Emphasis is laid upon the importance of making immediate hotel reservations. Applications should be made to the Accommodation Department of the B.I.F., Chamber of Commerce, New Street, Birmingham.

National Gas Council

Meeting of the Central Executive Board

A meeting of the Central Executive Board of the National Gas Council was held at Gas Industry House, 1, Grosvenor Place, S.W. 1, on Tuesday, Jan. 12. Pending the arrival of Sir David Milne-Watson, LL.D., D.L., the Chair was taken by Mr. WILLIAM CASH, F.C.A., J.P.

Before commencing proceedings, the Chairman on behalf of the Board welcomed Councillor W. P. Jackson to the Board as representing the British Commercial Gas Association in place of Mr. Stanley Taylor, whom he succeeds as President of the Association.

Joint Standing Finance Committee.—It was reported that this Committee held a meeting on Dec. 16 for the purpose of considering the financial position of the National Bodies.

After considering the revised estimates the Committee decided to adjourn until a date to be fixed in March, when further figures would be submitted by the National Bodies. The report was approved and adopted.

Air Raid Precautions for Gas Undertakings.—The position with regard to this matter was carefully considered, and it was decided to send certain available information to all members of the Council.

At this juncture Sir David Milne-Watson joined the meeting and took the Chair.

Coal.—Consideration was given to numerous aspects of the coal question. Particular reference was made to the fact that gas undertakers had no information as to the principles which were guiding coalowners in operating their statutory monopoly, and to the absence of relevant information to enable gas undertakers to decide whether they were or were not fairly treated.

It was reported that a meeting of the Central Joint Consultative (Gas Coal) Committee was being held on the following day.

Joint Select Committee—Basic Price System.—It was reported that the Joint Committee set up by Parliament had met on Dec. 15 for the purpose of considering their procedure, and Sir Alan Anderson had been elected Chairman. The Committee had adjourned until Feb. 9 in order to allow the interested parties to prepare their evidence.

Conjoint Conference of Public Utility Associations.

(*a*) *5th Annual General Meeting to be Held on Jan.* 28, 1937.—It was reported that this meeting would be held in the Board Room at Gas Industry House, and would be presided over by Lord Mount Temple.

(*b*) *Representatives of the National Gas Council to Serve on the Council of the Conjoint Conference.*—The following representatives were elected to serve on the Council, viz.: Mr. R. Halkett, Alderman Sir William Kay, J.P., Mr. T. Hardie, M.Inst.C.E.. Mr. A. W. Smith, F.C.I.S.. Mr. H. C. Smith, M.Inst.C.E., and Mr. W. J. Smith, B.Sc. (Bolton).

(*c*) *Representatives to Attend the 5th Annual General Meeting.*—Under the Constitution, ten gas representatives

can attend the Annual Meeting. It was agreed that the six gas representatives serving on the Council of the Conjoint Conference should be nominated to attend the Annual General Meeting, and that it be left to the Officers to obtain four additional representatives to complete the representation of the gas interests.

B.I.F.—Joint Gas Conference—Feb. 23-25, 1937.—It was reported that the Presidential Address would be delivered by Lord Dudley on Feb. 23, and that a luncheon would take place on the same day. On Feb. 24 there would be a display of films.

Royal Sanitary Institute Health Congress, Birmingham, July 12-17, 1937.—The Board approved the nomination of Mr. George Dixon, of Nottingham, and Mr. C. M. D. Belton, of Shrewsbury, to represent the Council at the above Congress.

World Power Conference—Report in Regard to Coal Specifications so Far as Relating to Coal Used for Gas Manufacture.—It was stated that the Report, which had been circulated, set out the relative importance of certain characteristics of coal used for the manufacture of gas, and asked that further study should be given by each nation to the ascertainment of new methods of determining such characteristics as could not to-day be determined in the laboratory.

It was decided to refer the Report to The Institution of Gas Engineers, with the request that they should inform the Council as to the reply they would wish sent.

Date of the Next Meeting.—As the Enquiry by the Joint Committee on Basic Prices would take place on Feb. 9, it was decided to postpone the usual monthly meeting of the Board in February, and to summon an emergency meeting should this be found necessary.

The "Rotapan" Gas Steamer

Leamington Demonstration

On Tuesday of last week Mr. R. S. Ramsden (Engineer and General Manager of the Leamington Priors Gas Company) gave a demonstration to Leamington hotel and boarding-house keepers of the "Rotapan" gas heated steam cooker—a product of the Brockhouse Heater Co., Ltd., which has previously been described in these columns.

This labour-saving steamer is capable of serving the requirements of eighty to a hundred persons, and contains four food compartments—one large one on top and three lower pans which swivel out. The Leamington audience were highly interested in the demonstration, which showed the extremely economical operation of the appliance.

The Leamington Priors Gas Company are prepared to fix a "Rotapan" in any establishment on trial.

Change of Address

Mr. A. Webster, Technical and Trade Journalist, who is well known to members of the Gas Industry through many years' attendance at Institution Meetings and other conferences, and is one of the best known technical shorthand writers serving a large variety of industries, informs us that on and after Jan. 20, 1937, his style and address will be:

WEBSTER & PURCHASE,
Wellington House,
125-130, Strand,
London, W.C. 2.
Telephone: Temple Bar 8584.

Patents and the B.I.F.

A Useful Handbook

In view of the nearness of the B.I.F., it is important that firms exhibiting new ideas and inventions should realize that the mere fact of the B.I.F. being certified by the Board of Trade to be an Industrial Exhibition recognized for the purposes of the Patents and Designs Acts does not in itself enable exhibitors to show unprotected inventions without prejudicing their rights therein.

It is essential before exhibiting to file a description of an invention in the prescribed form at the Patent Office.

Messrs. Kings Patent Agency, Ltd., of 146A, Queen Victoria Street, E.C. 4, to whom we are indebted for the above information, issue a Handbook on Patents and Trade Marks which will be sent free to interested enquirers, and which explains the formalities required in connection with the above.

Institution of Gas Engineers

British Standard Specifications

Copies of the following recently published British Standard Specifications are obtainable from the Secretary, The Institution of Gas Engineers, 1, Grosvenor Place, S.W. 1:

No. 417-1936.—Galvanized mild steel cisterns, tanks, and cylinders (superseding No. 417-1931).
No. 699-1936.—Copper cylinders for domestic purposes (Grades 1, 2, and 3).
No. 716-1936.—Mild steel rigging screws, and stretching screws and turnbuckles for use with wire ropes for general engineering purposes.
No. 717-1936.—"Combustion testing" of domestic gas appliances.
No. 718-1936.—Density hydrometers.

Forthcoming Engagements

Jan.

21.—B.C.G.A.—District Meeting at Birmingham.
21.—SOUTHERN ASSOCIATION (EASTERN DISTRICT).—Meeting at Gas Industry House, 2.30 p.m. Discussion on "Unaccounted-for Gas."
21.—S.B.G.I.—Council Meeting, 2.30 p.m.
22.—B.C.G.A.—Annual Meeting of Yorkshire District Members at Leeds.
22.—LONDON AND SOUTHERN JUNIORS.—Paper by T. J. Legge and T. G. Noble, "Baffler Performance in Relation to the Safety of Gas Appliances."
23.—MIDLAND JUNIORS.—Visit to Walsall Gas-Works.
23.—SCOTTISH WESTERN JUNIORS.—Visit to Port Glasgow Gas-Works.
23.—WESTERN JUNIORS.—Visit to Works of Swindon United Gas Company. Paper by D. A. Vince, of Swindon.
23.—WALES AND MON. JUNIORS.—Meeting at Neath. Paper by D. Rees, of Neath, "Reconstruction of an 1877 Gasholder."
27.—B.C.G.A.—Annual Meeting of Members in Scotland, Edinburgh.
28.—B.C.G.A.—District Meeting at Newcastle-upon-Tyne.
29.—B.C.G.A.—District Meeting at Exeter.
29.—I.G.E.—Liquor Effluents and Ammonia Committee, 11.15 a.m.; Joint Research Committee, 2.30 p.m.

Feb.

2.—B.C.G.A.—Annual Meeting of members in Manchester District, Midland Hotel, Manchester, 3 p.m.
3.—MANCHESTER AND DISTRICT JUNIORS.—Visit to West's Gas Improvement Co., Ltd.; Paper by J. Holland, "Works Reconstruction with Economies."
3.—LONDON AND SOUTHERN JUNIORS.—Visit to Davis Gas Stove Company, Ltd., and Electrolux, Ltd., Luton.
4.—MIDLAND JUNIORS.—Paper by W. N. Smirles, "Gas-Heated Hot Water Systems."
5.—MANCHESTER ASSOCIATION.—Visit to Works of Walpamur, Darwen; Paper on "Painting and Maintenance of Structural Work."
6.—SCOTTISH WESTERN JUNIORS.—Annual Whist Drive and Dance.
6.—SCOTTISH EASTERN JUNIORS.—Visit to Dundee Gas-Works; Paper by D. Warden.
12.—LONDON AND SOUTHERN JUNIORS.—Paper by F. O. Hawes, "The Effects of Changes in Composition upon the Combustion of Town Gas."
13.—SCOTTISH WESTERN JUNIORS.—Debate Meeting.
17.—B.C.G.A.—Meeting of Executive Committee, 11.30 a.m.
18.—JUNIOR ASSOCIATIONS.—Visit to B.I.F., Birmingham.
20.—WESTERN JUNIORS.—Meeting at Bath; Paper by F. G. Craxford, "The History and Development of Gas Fitting."
23-25.—B.G.F.—Joint Gas Conference at the B.I.F., Birmingham.
26.—I.G.E.—Gasholder Committee, 2.30 p.m.
27.—SCOTTISH JUNIOR ASSOCIATION.—Joint Meeting at Edinburgh; Paper by F. B. Holmes, "Scrubbers."

March.

12.—MANCHESTER ASSOCIATION.—Annual Luncheon. Midland Hotel, Manchester, 1 p.m. Mr. R. N. Webb will subsequently read his Presidential Address.

Town Gas and Pottery

Further Advances Expected

On being invited to give his opinion as to the relative merits of town gas and producer gas in the use of tunnel kilns for the firing of pottery, Mr. H. B. Shook, a well-known furnace expert, in an Address to the Ceramic Society at Stoke-on-Trent on Tuesday, Jan. 12, said it was a question of economics. The adoption of town gas, where it was available at an economic figure, was certainly an advantage in respect of the fact that it was not necessary to wad the " saggars " when firing glost ware.

He thought it likely that there would be further advances before long in connection with the use of town gas, for when the price of that commodity was brought down to a really attractive proposition it would mean that the small manufacturer or the one with only an average-sized works would be definitely interested in continuous firing, inasmuch as he would then not have to consider the extra capital expenditure which the erection of a gas producer entailed. In using a clean fuel, such as town gas, the complete operation of such a kiln as a tunnel kiln was automatic. In some cases it was a distinct advantage to eliminate " saggars " completely and place the biscuit or glost ware in the open. The semi-muffle type of kiln arranged to do this had given very satisfactory results.

Wigan Holder Inaugurated

An Anxious Year Over

Wigan's new £23,000 gasholder was inaugurated on Thursday, Jan. 14, when Councillor James Horne, Chairman of the Gas Committee of the Wigan Corporation, operated the valve which released gas from the new holder into the town mains. Members of the Town Council and officials of the Corporation were present, including the Mayor (Councillor P. Winstanley), the Town Clerk (Mr. W. H. Tyrer), the Gas Engineer (Mr. J. Monks), and Mr. F. J. Siddall, representing Messrs. R. & J. Dempster, Ltd., of Manchester, who erected the gasholder.

The holder has a capacity of 2 million cu.ft. and is 151 ft. in diameter. It has four lifts, each 30 ft. deep. The cost is being paid out of revenue.

Performing the ceremony, Councillor Horne said this was an important event in the history of the Gas Undertaking. It had been an anxious year for the Committee as to whether they would be able to maintain the supply, but now that the new holder was erected it was a great relief to the Committee, for now they were out of any danger with no fear of being unable to supply the consumers.

After the ceremony those present were taken on a tour of inspection of the Works, and saw the complete process of gas production. Later they were entertained to dinner in the Court Hall, Wigan, as guests of the contractors.

Johns Hopkins School of Engineering

Baltimore Institution Celebrates 25th Anniversary

The Johns Hopkins School of Engineering at Baltimore, Maryland, will celebrate the twenty-fifth anniversary of its founding by a programme of events extending over Feb. 19, 20, and 22. Outstanding American Engineers are to take part in a period of technical sessions, when Papers on research problems are to be read, and an exhibition of industrial and research material will attract wide attention.

The principal event is to be an Address at the Sixty-First Commemoration Day exercises of the University on Feb. 22 by Dr. Karl T. Compton, President of the Massachusetts Institute of Technology, and one of the leading figures in technical education in the United States.

With a view to indicating important progress over the entire range of engineering development, each of the several departments of the Hopkins School will exhibit representative processes, devices, and models from modern technical science. Dr. Wilbert J. Huff, Professor of Gas Engineering, is supervising arrangements for a display on the combustion of gases and the apparatus used in testing them.

Dr. Huff is Chairman of the Chemical Committee of the American Gas Association and of the Gas and Fuel Division of the American Chemical Society. Some of his researches have resulted in the addition of important processes in his field. As Chief Chemist of the Explosives Section of the U.S. Bureau of Mines, he has directed important work relating to gaseous atmospheres in manholes and mines and to safety in the use of explosives.

As part of the chemical engineering display, soft metals will be melted by the use of immersion burners, and a gas flame will be shown burning under water. Much material of interest will be afforded by the exhibition of new processes invented by research groups, especially that for removing sulphur compounds from commercial gases at elevated temperatures. Experiments in the burning characteristics of gases, the analysis of oils and gasoline, the evaluation of iron oxides for gas purification, and methods for the recovery of by-products may be observed.

Also on view will be a model of a coke oven battery; the working parts of a gas refrigerator; the apparatus for distilling coal and for examining tar, oils, and gas; and novel forms of gas analysis apparatus developed at the Hopkins School.

Papers by the principal members of the faculty are to be read at the morning conference sessions on Feb. 20. Dean J. B. Whitehead, first professor of electrical engineering upon the opening of the School in 1912, has arranged to invite officials of the State and City, leading industrial engineers, and many research specialists from other colleges to take part in the technical discussions.

The twenty-five years of the School's history have been characterized by progressive investigation and advanced instruction. Founded at a time when rapidly expanding industry put forth increased demands upon technological research, the School quickly gave evidence of the same quality of scholarship that has placed the parent University in the forefront among institutions of higher learning. A distinguished faculty and significant contributions to engineering science by its graduates have placed the School in the top rank of the world's technical colleges.

An Investors' Handbook

Useful Record of Prices

In the matter of Stock Exchange affairs, accurate knowledge of what has gone before is an invaluable aid to the forming of a sound opinion as to what is likely to come later; and this knowledge is admirably catered for in " Mathieson's Handbook for Investors "—an annual publication by Fredc. C. Mathieson & Sons, 16, Copthall Avenue, London, E.C. 2, price 5s. net—which is a record of the highest and lowest prices of, and the dividends paid on, a number of selected securities of varied kinds, extending over the past ten years. It does not, of course, necessarily follow that what has happened already will be repeated in the future, or that past achievements will not, in many cases, be left far behind by movements yet to come. But, generally speaking, ten years is a sufficiently long period to provide a useful guide, and the decade just completed may be regarded as particularly valuable from this point of view, inasmuch as it embraced both " fat " and " lean " years, and ended, as it began, on an upward curve.

Gas Companies have a section to themselves—not a large one, it is true, but one that makes an eminently satisfactory showing. Of the fourteen representative undertakings quoted in alphabetical order, there is none that is not able to render a good account of its stewardship, and the very first one included in the list records especially striking results. The Alliance and Dublin Consumers' Gas Company show a continuous rise in the highest quotations for the ordinary stock from 94 in 1927 to 172 up to end November, 1936. Among other undertakings, the ten years have witnessed a rise in the " highest " of the ordinary stock of the British Gaslight Company from 112 to 163, of the Croydon Gas Company's sliding-scale stock from 101 to 164½, of the Oriental Gas Company's capital stock from 110 to 172, and of the Tottenham and District Gas Company's ordinary stock from 94 to 156. Within the period covered, both the Gas Light and Coke Company and the Newcastle-upon-Tyne and Gateshead Gas Company ordinary stocks have come to be dealt in in units of £1, and in each case the highest price shows a very big gain in 1936, as compared with 1928. The single undertaking quoted whose ordinary stock had a lower maximum price in 1936 than in 1927 is the Montevideo Gas and Dry Dock Company, whose failure to keep in step with the others has been caused by circumstances beyond its control. While saying this, it is only fair to remark that, in other cases prices have enjoyed the favourable influences of " cheap money."

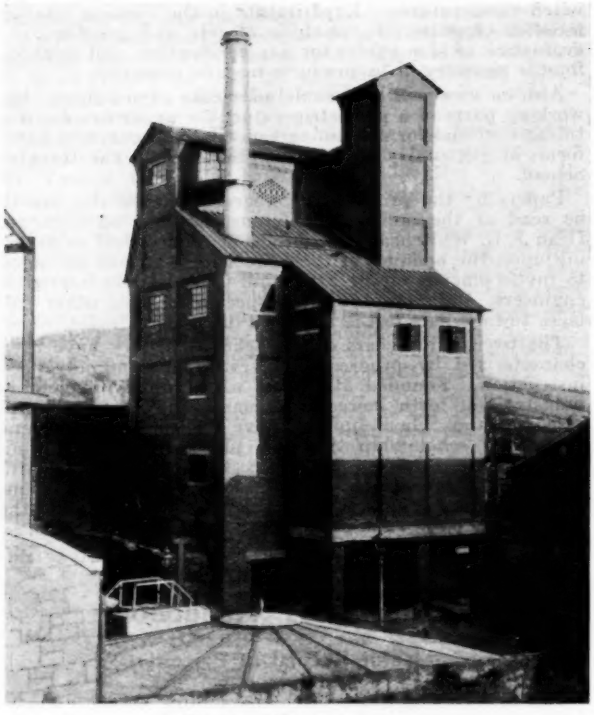
Another useful little booklet published by the same firm (price 1s.) is the " Investor's Pocket List of Reference Tables." This includes a table headed " Income-Tax at 4s. 9d. in the £." Surrounded as we are, by whisperings of new taxation needs, we can do no more than express the hope that, after the opening of the next Budget, this table may still remain applicable to the incomes of our readers.

NEW VERTICAL RETORT INSTALLATION

At Campbeltown

Woodall-Duckham Plant Inaugurated

A new installation of Woodall Duckham Continuous Vertical Retorts was officially inaugurated at Campbeltown on Jan. 14 to cope with the town's increasing gas consumption.



The New Retort House.

The earliest known records show that the Gas-Works were originally established on the present site by a Joint Stock Company in 1830. In 1876 the Town Council promoted a Parliamentary Bill to purchase the Gas-Works. The Corporation were successful, and in 1880 purchased the Gas-Works for the sum of £9,712 5s. 6d. The make of gas at this date was 16 million cu.ft.

After the Corporation took possession, a considerable sum was spent in making additions to the works and extending the undertaking in various directions until 1904, when the then Gas Committee formed the opinion that the plant had reached the end of its useful career and decided to modernize the works at considerable expense.

In 1936, the make of gas having increased to 46 million cu.ft. and the horizontal retorts having reached the end of their useful career, it was decided to install new carbonizing plant.

The new gas-making plant comprises one bench containing three latest type upwardly-heated Woodall-Duckham continuous vertical retorts and is capable of carbonizing 20 tons of coal and of producing 300,000 cu.ft. of 475 B.Th.U. gas per day. The gas used for heating the retorts is made in two producers situated at ground level at one side of the bench. The installation is provided with a lift for handling coal and coke, with a coke screening and storage plant and with a waste-heat boiler. It is erected in a new steel-framed brick panelled retort house which is large enough to house an additional retort.

The three retorts are set in single line with hollow division walls between them so that any one retort can be heated-up or let-down without in any way interfering with the working of the other retorts.

The retorts are about 25 ft. high, rectangular in plan, and tapered to allow continuous regular descent of the coal; they are 53 in. long and 10 in. wide at the top. They are designed according to the latest "W.-D." practice and incorporate the now well-known system of upward heating in vertical flues.

The retort bottom castings are designed to provide specially easy access for inspection and spraying without dismantling the castings. By this means the lower parts of the retorts can be sprayed regularly, when the retort is empty for scurfing; and slagging of the brickwork, caused by the chemical action of the ash liberated by steaming, can be avoided in this region where there is no protection by scurf formation.

Coal is discharged into a receiving hopper of 5 tons capacity arranged below ground level and fitted with a 3½-in. mesh grid to prevent oversize coal from entering the retorts. From this hopper the coal is fed into a side-discharge skip which is run in a subway into a 25 cwt. steam-driven lift and elevated to the top level of the overhead storage hopper arranged above the retort bench.

The coal entering the retort is kept clear of the gas offtake pipe by a special deflecting plate which allows ample space for the gas flow from the coal. The offtake pipe, which is of suitable area to ensure equalization of pressures and is so arranged as to be readily cleaned, leads the gas into a mushroom valve, which is connected to the top of the collecting main along one side of the bench. This valve provides for the closing off of the individual retort from the collecting main when the retort is being scurfed or is let down cold.

The collecting main is of the hydraulic type, and as the gas enters the main it impinges on the surface of the ammoniacal liquor therein and deposits tarry products. The main is constantly flushed with hot ammoniacal liquor. The gas passes from the collecting main through an uptake into the foul main. Here it is sprayed with hot ammoniacal liquor. The foul main is fitted with a butterfly valve operated by an "Arca" gas regulator, which regulates the pull on the retorts.

Producers.

The producers are arranged so that one producer may be shut down without interfering in any way with the working of the other, and so that the gas from either or both may be taken to any of the retorts. Each is constructed with ample grate area for the efficient heating of three retorts when using a mixture of coke and breeze.

The waste gas main conveys the gases either directly to the chimney or to a waste-heat boiler which is provided for utilizing the major portion of the heat contained in the gases. The waste-heat boiler, which is of the Woodall-Duckham horizontal fire-tube natural-draught type, is designed for a working pressure of 100 lb. per sq.in. It is of a size to deal with the waste gases from a finally completed bench of four retorts.

In order that the boiler may give a surplus of steam for works requirements, after those for the vertical retort plant have been met, provision is made so that a supplementary supply of producer gas can be mixed with the waste gases before they are passed to the boiler, a supplementary combustion flue being provided.

The waste-heat boiler provides the whole of the steam supply to the retorts, producers, lift, and liquor pumps, and a considerable surplus is available for other works purposes.

The contents of the coke chambers beneath the retorts are discharged either into the side-discharge skip or into a mild steel barrow. For dealing with the coke required for the producers the skip is run into the lift and elevated to the level of an overhead gantry. Here it is run out of the lift on to the gantry and discharged into a hopper and feeding chute arranged for feeding the coke direct to the producers as required. For dealing with the surplus coke the skip is elevated by means of the lift to the same overhead gantry, along which it is run and its contents are discharged through a chute to a static wire mesh screen for separating the breeze from the coke. The breeze and coke are delivered into separate compartments of a steel-framed brick-panelled hopper with steel bottom and division plate. This hopper has a total storage capacity of 22 tons of coke and breeze. The screened coke compartment is fitted with two chutes for feeding coke either to road vehicles or to a platform for bagging purposes; these chutes are fitted with hand-operated quadrant doors.

A REPORT ON

Flueless Heating and Comfort

The Report, extracts from which are given below, was prepared by an Advisory Committee appointed by the Royal College of Physicians, and has been published by that body at 1s. (1s. 2d. post free). It is obtainable from Harrison & Sons, Ltd., 44-47, St. Martin's Lane, W.C. 2.

At the request of the Governor of the Gas Light and Coke Company for advice and assistance from the Medical Profession in regard to problems arising from changes in building construction and the significance to health of the use of flueless gas heaters, the Royal College of Physicians approved the formation of a Medical Advisory Committee, nominated by its President, to examine available information, to initiate such research as might be thought necessary, and to make recommendations. This Committee was constituted as follows: *Chairman.*—Prof. W. W. Jameson, M.A., M.D., F.R.C.P., Professor of Public Health, University of London, Dean of the London School of Hygiene and Tropical Medicine. *Members.*—Sir Joseph Barcroft, C.B.E., M.A., F.R.S., Professor of Physiology, University of Cambridge; Guy P. Crowden, M.R.C.S., L.R.C.P., M.Sc., Reader in Industrial Physiology, University of London, London School of Hygiene and Tropical Medicine; Sir Arthur J. Hall, M.A., M.D., F.R.C.P., Emeritus Professor of Medicine, University of Sheffield; Reginald Hilton, M.A., M.D., F.R.C.P., Assistant Physician, St. Thomas's Hospital.

The main object of this Committee has been to consider, from the point of view of comfort and health, domestic heating in dwellings constructed in accordance with modern practice, but, as will be apparent from the report, fundamental problems and commonly accepted data have also been discussed, particularly in regard to ventilation, warmth, comfort, and the effects, if any, upon health of the products of combustion of coal gas.* The scope of the Committee's earlier deliberations and its preliminary general conclusions were indicated in a short Interim Report which was published in the "JOURNAL" for Aug. 14, 1935.

TECHNICAL REPORT.

I.—Comfort and Health.

The Committee has interpreted its terms of reference in the broadest possible sense as including not only considerations of danger to life and health but also the wider issue of comfort in dwellings.

The factors associated with artificial heating which influence comfort and health are of three main types—physical, chemical, and bacteriological. With the last this report is not concerned. Provided the air is pure within reasonable limits, ideal conditions of comfort are determined by the simultaneous operation of a number of physical factors which exert an influence on the heat exchange between the body and its environment.

The living body even when resting is continuously producing heat. In the case of a sedentary individual the heat produced has been estimated at 350-450 B.Th.U. per hour, the average figure being 400 B.Th.U. This heat must be got rid of by the body, and the rate and manner of its loss largely determines comfort sensations. In still air and at a relative humidity of 50% a normally clothed individual sitting in a room in which the temperature of the air and of the surroundings is approximately 60° F. loses these 400 B.Th.U. of heat approximately as follows: 45% by radiation, 31% by convection, and 24% by evaporation of moisture from the lungs and skin.[1,2,3,4]

In order to ensure average individual comfort it is necessary not only that the body should lose heat at a suitable rate, but also that the loss by radiation, convection, and evaporation should be maintained roughly in the proportions stated above. Hence it is necessary to give due consideration to the temperature, movement, and humidity of the air, and to the temperature of the solid surroundings. Of these factors, however, the temperature of the air and the temperature of the surroundings are ordinarily the most important so far as comfort conditions in dwellings in this country are concerned.

The temperature of the surroundings should not be much lower than that of the air, and under cold conditions it is preferable that some part of the surroundings should be at a temperature higher than that of the air.[5]

Satisfactory heating apparatus must therefore perform a double function: it must provide radiant heat to raise the temperature of the surroundings and convected heat to raise the air temperature and to maintain it at the level required for comfort. Varying circumstances necessitate the provision of these two forms of heating in varying proportions and must be taken into consideration in determining the type of heating apparatus most suitable for use in any particular instance.

There are many varieties of heating apparatus for home use, and some of the appliances and heating systems which supply heat without promoting ventilation need special consideration from the point of view of health. A wide range of flueless heating appliances is produced, and in the case of flueless gas heaters some deliver all their heat in the form of convected heat, while others give out approximately 50% in the form of radiant heat. According to the type of appliance the actual radiating surface may vary in temperature from only a few degrees above air temperature up to 1,400° F.[6]

Loss of body heat from the skin depends at high temperatures mainly upon the production and evaporation of sweat, the rate of heat loss being governed by the humidity and movement of the surrounding air. High temperature associated with high humidity is less tolerable than high temperature and dry air.[7] Artificial heating, by raising the temperature of the air, lowers the relative humidity to an extent determined by the rise of temperature and the amount of water vapour produced by the heating appliance.

It would appear that within a range of temperature of 60-70° F. the relative humidity may vary from 25-70% without materially affecting the sensations of comfort of a normally clothed sedentary individual.[8, 9, 10, 11] Further studies on the problem of desirable limits for indoor humidity in this country appear however to be necessary.

II.—Ventilation Requirements.

For many years the problem of defining and ensuring the provision of adequate ventilation of, or air change in, living rooms and bedrooms has been one of difficulty, both to housing authorities and to hygienists. The ventilation of rooms needs to be such that while health is safeguarded comfortable conditions of warmth may be readily and economically established and maintained under conditions of normal occupation.

The characteristic of flueless heaters as compared with heaters connected to a flue is that they provide no positive means of ventilation, except in so far as the heating of the air increases its buoyancy. Apart from this temperature effect the ventilation of rooms unprovided with special means of ventilation depends upon diffusion and upon external air movement due to wind. The effect of wind upon air change in domestic rooms is extremely variable, the degree of ventilation in many cases constantly changing according to the force and direction of the wind. The determination of any generally applicable figure for the air change in domestic rooms unprovided with flues therefore presents considerable difficulty. Investigations have been conducted on this subject by a number of observers and an examination of the collected data indicates the degree of variation which may be obtained.[12]

Ventilation in Small Flueless Apartments.

Important as the matter is, there seems to be some uncertainty as to whether the provision of a single air brick appreciably increases the ventilation of a flueless room. Rooms having flues with a source of heat at the base show, without exception, a degree of ventilation exceeding that which may be obtained in rooms having no such arrangement. Expressed as air change per hour, the degree of ventilation in small rooms shows a tendency to be higher than that in large rooms. In flueless rooms of less than 1,000 cu.ft. capacity an air change of more than 1 per hour is commonly found, whereas in larger flueless rooms the air change may fall as low as ¾ per hour or less. In view of the importance to the community of this matter, it is surprising to find how little precise information is available. *It is highly desirable that more extended tests should be carried out, especially in regard to the minimum degree of ventilation obtaining in small flueless apartments typical of certain modern buildings.* It is understood that this matter is at the present time under active consideration by the Health Organization of the League of Nations.

It is open to doubt whether in small occupied rooms an air change of 1 per hour or less may be regarded as satisfactory on grounds of health and comfort. Houghten, Yaglou, and others have studied the question of the intensity of human odours in occupied rooms and although the conclusion has been reached that it is not possible, owing to individual variation, to fix any single standard of air change for general application

* The term "coal gas" used in the report should be read to mean "town gas" as supplied for domestic use.

on this basis, it appears, however, that from 9-12 cu.ft. of fresh air per person per minute are necessary to dilute body odours to a concentration which is not generally objectionable.[13]

III.—Heating Requirements.

The considerations outlined in the first section of this report show that no generalization can be made regarding the amount of heat produced by artificial heaters, flueless or otherwise, which will ensure that the temperature of the air and of the surroundings is raised and maintained at the necessary level of comfort. The need for careful selection of the appropriate type of heater to suit the local circumstances is obvious, whether the object of the appliance is solely to raise the temperature of the air or to provide air heating combined with low or high temperature radiation.

Subject, however, to these considerations it appears that if flueless heaters are used continuously in a room of normal type and medium size (1,000-2,000 cu.ft.) having an air change even of the order of 2 to 3 per hour, an allowance of about 1 cu.ft. of gas per hour per 100 cu.ft. of room space will be adequate to ensure comfortable conditions except during the most severe climatic conditions.[14]

If radiant heaters are appropriate it is possible to arrange them so that the occupants of the room receive the benefit of radiant heat and are kept under comfortable conditions even though the total heat emitted may be inadequate to maintain the whole of the room at comfort level.[2]

Gas heaters are frequently used intermittently and only turned on when required. Under such conditions it is necessary for the heater to be of greater capacity and to permit of easy control so that it may produce comfort conditions as quickly as possible and then be regulated to the desirable heat output. This can, of course, be achieved automatically by thermostatic control, or, less certainly, as a result of the natural reactions of the occupants of the room, who, when they become overheated, would probably turn down the gas or open a window.

Apart from the question of the significance of the products of combustion of coal gas which is fully discussed elsewhere in this report, it is of importance to consider whether under cold weather conditions a flueless gas heater burning gas at a rate of 1 cu.ft. per hour per 100 cu.ft. of room space will provide adequate warmth without causing excessive humidity. Although common experience justifies the statement that such a gas rate is satisfactory, it is of interest to examine a concrete case as, for example, the provision of heat in a small room of 500 cu.ft. capacity and the following dimensions: 10 ft. × 7 ft. 3 in. × 7 ft. high. It is assumed also that the room has two outside walls on an exposed corner of the top floor of a building, that the ceiling is lath and plaster under an unlined tile roof, that the window has a glass area of 5 ft. × 3 ft., and that the walls consist of 9-in. brickwork and plaster. If the outdoor air temperature is 40° F., the wind velocity 15 m.p.h., and the ventilation of the room 1½ air changes per hour, then it may readily be calculated from data of the heat transmission of building materials that, when the inside temperature is kept at 65° F., heat will be lost from the room at the rate of approximately 2,550 B.Th.U. per hour. A gas rate of 1 cu.ft. per hour per 100 cu.ft. of room space would correspond to the use in the room of a flueless gas heater consuming 5 cu.ft. of gas per hour, and, as each cubic foot of gas burnt yields approximately 500 B.Th.U., heat would be liberated into the room at a rate of 2,500 B.Th.U. per hour—substantially the same rate as the calculated heat loss. It can also be shown that without allowing anything for the absorption of water vapour by the walls and furnishings the humidity would be unlikely to exceed 70%. Increased air change has a comparatively small effect on the heat requirements. In the example quoted above an increase from 1½ to 3 air changes per hour increases the heat requirements by about 28% for maintenance conditions. With intermittent heating during the heating up period, owing to the thermal capacity of the brickwork, only 4% increase in heating may be required for a doubling of ventilation.

IV.—Products of Combustion from Gas Appliances.

The Committee's attention has been drawn to the work carried out by a number of gas undertakings and gas appliance manufacturers on the products of combustion of gas. Tests on these products are found to be a matter of routine procedure under qualified control and amount to thousands in this country every year. Numbers of technical papers have been published on this subject,[15, 12] and these publications, together with some of the laboratories, have been examined by the Committee. The accuracy of the results is confirmed by comparison with similar tests conducted by observers elsewhere.

The Committee has considered in detail the physiological effects of the gases constituting the products of combustion of coal gas and the possibility of any of these gases reaching significant concentrations under practical conditions where flueless gas heaters are used.

The composition of town gas varies considerably, but the following may be regarded as representative percentage analyses:[16]

Carbon dioxide	4·0	2·5	2·0
Unsaturated hydrocarbons	2·0	3·5	3·6
Carbon monoxide	18·0	15·0	8·0
Oxygen	0·4	0·8	0·4
Methane	20·0	22·0	30·0
Hydrogen	49·4	48·0	52·0
Nitrogen	6·2	8·2	4·0
Calorific value, B.Th.U. per cu.ft. gross	475	500	560

Sulphur, chiefly in the form of carbon bisulphide, is also present to an extent varying roughly from 10 to 30 grains per 100 cu.ft. of gas.

Each cubic foot of gas requires 4-4½ cu.ft. of air for its complete combustion and when burnt produces about ½ cu.ft. of carbon dioxide and 1 cu.ft. of water vapour. In addition, small quantities of sulphur oxides are formed in proportion to the amount of sulphur present in the gas, and very small amounts of carbon monoxide and nitrogen oxides are also produced.[17]

Tests carried out with flueless gas appliances on the distribution of products from floor to ceiling indicate that the concentration is relatively low at floor level, due to floor draughts, but at heights above 1 ft. from the floor little variation is noticed.[18, 12]

Calculation of the Concentration of Products.

It may therefore be assumed that the concentration of products of combustion may be calculated on the basis of their being quickly and evenly distributed throughout the room. Tests show, however, that the concentration of sulphur oxides in the air of the room is substantially below that corresponding to the sulphur content of the gas itself, rarely exceeding 50% of the calculated value and often very much less. This is due to the continuous absorption of the sulphur oxides by the walls, ceiling, and furnishings of the room. Nitrogen oxides show a similar reduction to levels below the calculated values.

Combustion is never chemically complete in practice, but the degree of incompleteness is significant only when the supply of oxygen is inadequate (*e.g.*, a geyser with excessive gas rate) or when a non-aerated flame is chilled through contact with a cool surface, *e.g.*, as would occur if luminous non-aerated burners were used on a cooker hotplate). The formation of products of incomplete combustion, which may include carbon monoxide, aldehydes, acetylene, and hydrogen, depends on circumstances affecting combustion in the appliances used.[19, 20, 21]

The effect of highly vitiated air on the process of gas combustion varies with different burners and gas appliances. In some cases combustion remains unaffected up to a carbon dioxide concentration of 7%, with associated oxygen deficiency. In other cases carbon monoxide may be produced if the concentration of carbon dioxide exceeds 1·5%. In general a gas appliance may be relied upon to be satisfactory up to the maximum degree of air vitiation which is likely to result from its normal operation. Combustion has been notably affected at degrees of vitiation which could occur under practical conditions only when the appliance has initially been of unsatisfactory construction or when it has been operated at an excessive gas rate. These conclusions have been confirmed by a number of workers.[12]

Satisfactory combustion is achieved by suitable design, by correct installation and maintenance of the gas appliance, and by the observance of the proper rate of supply of gas to the burners. Most appliances are tested to take a gas rate of 25 to 40% in excess of the normal while maintaining the necessary combustion standard.[22, 15]

The standard of combustion that should be shown by gas appliances is normally expressed as a CO/CO_2 ratio, and this at the maximum gas rate possible should not exceed 0·01—*i.e.*, if the concentration of carbon dioxide in the products of combustion in the air of a room amounted to 1%, the concentration of carbon monoxide would not exceed 0·01%. The standard for other countries varies between 0·005-0·02 for different appliances and under different conditions of test.[23] Under normal conditions of use gas appliances and especially flueless gas heaters are found to show a ratio far below this limit—usually 0·002 or less.[15]

The Committee has examined the Report to the Board of Trade of the Departmental Committee on Deaths from Gas Poisoning, 1930,[24] and has been informed of the steps taken by the larger undertakings and makers since the publication of that Report. It is stated that there is general agreement among the manufacturers and the larger undertakings as to the type of test to be carried out on gas appliances. These tests involve the estimation of the amount of carbon monoxide in the products of combustion at normal gas rates and over-load gas rates. A draft specification has been prepared by The British Standards Institution covering the method recommended for the proper carrying out of these tests. Appliances are examined critically to ensure that their construction is such as to maintain a satisfactory combustion standard on normal operation in consumers' homes. Tests are carried out to determine the efficiency and general performance of the appliance with a view to making certain that a satisfactory service can be obtained by the consumer at the normal gas rate. Information regarding methods of test and results of test is interchanged between the larger undertakings and is discussed with the various appliance manufacturers, and the larger undertakings have made provision for the adequate maintenance and repair of appliances in the homes of consumers. There are in existence British Standards Specifications governing the construction of fittings to be used with gas appliances, such as tubing—both rigid and flexible, connectors for use with flueless gas appliances, and the like.

V.—Water Vapour.

The relative humidity of room air has already been referred to in the section dealing with general considerations of comfort and health where it is pointed out that within the usual temperature range encountered in this country the changes in indoor humidity are of little significance to comfort. Inasmuch

as gas heating may cause a rise in air humidity owing to the fact that water vapour is one of the products of combustion of gas, it is necessary to consider this matter further. It may be pointed out that the walls and furnishings exert a compensating effect by absorption and, except in over-crowded rooms where the air becomes excessively moist on account of the water vapour given off in the expired air and from the skin of the occupants, the relative humidity is unlikely to rise to a level where it would appreciably affect comfort. Under conditions of normal occupation, a continuous gas rate of 1 cu.ft. per hour per 100 cu.ft. of room space, or the intermittent use of a rate twice this figure for quick warming up, would not lead to a significantly high humidity.

It has been shown by investigators that a relative humidity of 80% is rarely reached in rooms heated by flueless gas heaters and that normally the humidity remains at levels between 50 and 70%.[12]

In rooms with cold walls and ceilings, the surfaces of which are non-absorbent, there is a possibility of local condensation and while such deposition of moisture may give rise to complaint, it does not mean that the humidity of the air is necessarily excessively high. It is a matter of common experience that condensation may form on the inside of windows in cold weather. For example, if the outdoor temperature is 40° F. and the indoor 65° F. the inside surface of a ¼-in. glass window may have a temperature of 53° F. When the relative humidity of the room air rises to approximately 70%, moisture will condense on such a surface.

VI.— Carbon Dioxide and Oxygen.

The effect of breathing air containing different concentrations of carbon dioxide and oxygen has been studied by a number of workers.[25, 26]

A good deal of misunderstanding, however, still exists in the public mind in regard to the supposed harmful effects of carbon dioxide owing to the fact that its concentration has long been used as a gauge of the efficiency of ventilation in dwellings. The proportion of carbon dioxide serves as a useful index of air change in rooms, but there is no evidence whatsoever that concentrations of carbon dioxide much greater than those encountered in overcrowded rooms have any deleterious effects.[27, 28]

Exposure to a concentration of 2% carbon dioxide (oxygen 17·5%) results in deeper breathing, although the effect is not usually noticeable subjectively. At 4% carbon dioxide (oxygen 14%)—a concentration at which matches are extinguished and candles will not burn—panting and discomfort are noticed, but no ill result apart from headache is likely to follow even prolonged exposure.

It has already been noted that on the combustion of town gas ½ cu.ft. of carbon dioxide is formed with the removal of the oxygen in 4-4½ cu.ft. of air (*i.e.*, about 1 cu.ft. of oxygen) for each cu.ft. of gas burnt. A similar change would result from the presence of persons in the room. The volumes of carbon dioxide formed and of oxygen removed will largely depend on muscular activity. A person at rest exchanges about ½ cu.ft. per hour of oxygen for approximately the same volume of carbon dioxide. The total volumes of carbon dioxide formed and of oxygen removed in occupied rooms as a result of the consumption of gas in flueless appliances will depend on the gas rate per hour and the number of persons present. If the normal diffusion of the air is impeded the amount of carbon dioxide increases and the oxygen decreases.

Even with a minimum air change and under conditions of gross vitiation and overheating such as would result from a continuous gas rate of 1 cu.ft. per hour per 50 cu.ft. of room capacity, the maximum carbon dioxide concentration will only be about 1%. Such a concentration of carbon dioxide has no physiological significance and has been shown earlier to have no ill-effect on the combustion of gas appliances.

VII.—Carbon Monoxide.

The physiological action of carbon monoxide was described in a classical Paper by Haldane in 1895[29] and his views have been upheld by the majority of physiologists.[30, 31, 32, 33] Haldane showed that the toxic effect of carbon monoxide was due to its power of forming a loose combination with the hæmoglobin of the blood and so limiting the absorption of oxygen to an extent ultimately determined by the amount of carbon monoxide present in the air breathed.

It is, however, important to note that the affinity of carbon monoxide for hæmoglobin is approximately 300 times that of oxygen, so that quite small concentrations of carbon monoxide in air breathed continuously will lead to an appreciable decrease in the oxygen carrying capacity of the blood. The rate at which the blood absorbs carbon monoxide from the air depends upon the amount of air breathed per minute and the flow of blood through the lungs. Hence, bodily exertion by increasing both the pulmonary ventilation and the circulation rate causes a more rapid absorption of carbon monoxide. Thus, according to Haldane,[34] the blood of a sedentary individual breathing air containing 1% of carbon monoxide would become 50% saturated in 15 minutes, but if the individual actively moved about, this degree of saturation might be reached in five minutes.

Henderson showed that a man walking quickly absorbs carbon monoxide twice as fast as when at rest, and in the case of a man doing heavy manual work the rate of absorption of the gas and associated diminution in the oxygen carrying capacity of the blood would be three times the rate when resting.[35]

It was at one time thought that carbon monoxide had specific poisonous effects apart from its power of combining with hæmoglobin. This matter is dealt with below in the examination of the evidence for chronic poisoning. The non-existence of such effects is a matter of great importance for it means that with the removal of carbon monoxide from the blood the individual is restored to normal provided the oxygen deficiency has not been of such a degree as to cause permanent damage to the nerve cells. If, after an atmosphere containing carbon monoxide has been inhaled, fresh air is breathed deeply, the gas is rapidly given off by the blood and exhaled, and following the removal of carbon monoxide the oxygen carrying capacity of the red blood cells remains unimpaired.

A resting individual breathing air containing 0·02% carbon monoxide may develop symptoms of mild poisoning on six hours' exposure, but as shown by Sayers[31] and others no permanent deleterious effects result from such an exposure.

Evidence is accumulating to show that a considerable degree of acclimatization to carbon monoxide develops as a result of repeated exposures to low concentrations of the gas. This acclimatization bears some analogy to acclimatization to rarified atmospheres encountered at high altitudes.[36]

Chronic Carbon Monoxide Poisoning.

While the occurrence of acute poisoning by carbon monoxide has been long known and fully studied so that its clinical and pathological features are familiar and easily recognized, it is quite otherwise as regards so-called chronic carbon monoxide poisoning, that is, poisoning as the result of exposure at repeated intervals to concentrations of the gas insufficient to produce symptoms of acute poisoning, even when breathed over a long period.

Among the public there is a more or less widespread impression that various conditions of ill-health short of acute poisoning may arise from frequent exposure to this gas. Cases alleged to be of this character have also from time to time been recorded in the literature, and most of the standard text books dealing with the subject devote considerable space to the description of its manifestations.

Before coming to a definite conclusion on this point it is desirable to go carefully into the available evidence and see how far the existence of such an entity as chronic carbon monoxide poisoning has been satisfactorily proved.

In the first place it is important to define clearly what is meant by chronic carbon monoxide poisoning. In this report the definition given above will be adhered to—namely, a condition of ill-health due to exposure at repeated intervals to a concentration of carbon monoxide, less than can give rise to acute poisoning even on prolonged continuous exposure.

This point is emphasized, because in some of the cases recorded in the literature as cases of chronic poisoning it is admitted that the concentration of carbon monoxide to which the persons were exposed at the time was such as to give rise to symptoms of acute poisoning in its milder form (0·04 to 0·05%). Such cases cannot be included as instances of chronic poisoning.

Secondly, it is desirable to clear up the confusion which has arisen in the use of the word "cumulative" in connection with this particular gas. Various authorities employ it with two quite different, indeed almost mutually contradictory, meanings. Thus, Haldane[29] says "carbon monoxide is a cumulative poison" and Glaister and Logan[37] write "carbon monoxide poisoning, owing to its cumulative action, may occur even in the open air." On the other hand, Peterson, Harries, and Webster[38] in their text-book on legal medicine write "carbon monoxide is not a cumulative poison." These apparent contradictions are merely due to the two different meanings of the word "cumulative."

Haldane, Glaister, and Logan, and others who say that carbon monoxide is "cumulative," mean by "cumulative" that when a person is exposed to a toxic concentration of carbon monoxide it accumulates in the blood until this becomes saturated to a sufficient degree (33%) and it is not until then that the symptoms of poisoning begin. In this sense carbon monoxide is certainly cumulative.

Peterson, Harries, and Webster, however, use the word "cumulative" in an entirely different sense—namely, in the sense in which it is applied to poisons generally. In many of them poisoning may be either acute or chronic, according to whether one single poisonous dose has been taken, or a series of small non-poisonous doses have been taken at intervals. Thus, in the chronic form of lead poisoning, frequent small non-poisonous doses are stored in the tissues, so that in the course of time these contain sufficient lead to cause symptoms of chronic poisoning. In this way lead is said to have a "cumulative action."

It is agreed that there is no storage of carbon monoxide in the tissues of the body and that, after exposure to the gas ceases, the carbon monoxide in the blood is completely eliminated on breathing pure air; it therefore has no "cumulative action" in the sense in which the term is commonly used in medicine.

It is unfortunate that the word "cumulative" should have been used in connection with carbon monoxide in any other sense than this latter because it is obvious that the inability of carbon monoxide to be stored in the tissues makes a chronic form of carbon monoxide poisoning difficult to envisage.

Nor is this difficulty removed on reading the available records and descriptions of alleged cases. These may be roughly divided into four groups. First, those in which accurate data of all kinds are not forthcoming. Many of these occurred more than fifty years ago, when modern methods of gas and blood examinations were unknown.

Secondly, cases of slight acute poisoning, in which it is admitted that there was exposure to concentrations of such a degree as to be capable of producing symptoms.

Thirdly, a number of cases of various recognizable organic

diseases, in the causation of which carbon monoxide is not known to play any part.

Fourthly, cases of chronic ill-health, which have been attributed to carbon monoxide because improvement followed removal from the previous conditions of exposure.

In this last group, the subjective symptoms such as headache, tired feelings, indigestion, &c., described as due to chronic carbon monoxide poisoning, are so vague and so commonly met with in all walks of life that their particular relationship to poisoning by carbon monoxide would call for far stronger proof than is forthcoming from the records.

Indeed, so far as the evidence from the recorded cases goes, it is not possible to form a picture of any definite group of symptoms or signs, running any definite course, which can be recognized as the symptom complex of a chronic form of carbon monoxide poisoning.

On the other hand, certain experimental evidence points strongly the other way. Sayers[39] and others exposed six men for from four to seven hours daily for 68 days to exhaust gas mixtures varying in strength from 0·02% to 0·04% carbon monoxide. Although headaches occurred at the higher concentrations as would be expected, no harmful effects were produced on their general health.

Jacksch[40] in his article on chronic carbon monoxide poisoning suggests that probably the true nature of many cases of this kind is unrecognized and that many are wrongly diagnosed as something else. The Committee's impression after reading the recorded cases of supposed chronic carbon monoxide poisoning is exactly the reverse.

Carbon Monoxide Summary.

While exposure to carbon monoxide, even in very small quantities, may be capable of causing disagreeable effects at any rate in some people during the period of exposure, the available evidence is unconvincing as to the occurrence of any definite group of symptoms which would indicate a chronic form of carbon monoxide poisoning.*

This view is further supported by the recognized physiological fact that this gas is not stored in the tissues, and is therefore not a cumulative poison—in the usual medical sense of the term.

It has already been stated that a sedentary individual may breathe air containing 0·02% carbon monoxide for 6 hours and only develop mild symptoms such as slight headache and that there are no lasting deleterious effects from such exposure. In industrial work it has been shown that prolonged exposure to a concentration of 0·01% is permissible in that there is no evidence of harm resulting from breathing such an atmosphere. For short period exposure, as for example in the Mersey tunnel where considerable amounts of carbon monoxide are discharged into the air from the exhausts of motor vehicles, a maximum limit of 0·025%[41] carbon monoxide is ensured by automatic ventilating devices. In view of the vast amount of experience and evidence which is available as proof, the Committee feels quite justified in stating that a concentration of 0·005% of carbon monoxide in the air of a living room would be innocuous and that it might with safety be as high as 0·01%.

If coal gas is burnt in an appliance of good design combustion is practically complete and the percentage of carbon monoxide in the products of combustion before dilution with room air is less than 0·01%. Thus it is obvious that there must be serious defects in the appliance itself or in the fitting before harmful concentrations of carbon monoxide are likely to be produced in the air of a room.

It has already been shown that the highest CO/CO_2 ratio in the products of combustion of gas appliances burning under the most unsatisfactory conditions is 0·01, the normal being about 0·002. With a maximum carbon dioxide concentration of 1% these ratios correspond to a concentration of carbon monoxide of 0·01% and 0·002%, respectively, and, as shown above, there is no evidence that such concentrations are likely to be in any way injurious to health. Since the normal concentration of carbon dioxide in the air will correspond to very much less than 1% the normal concentration of carbon monoxide will rarely exceed 0·0005%.

VIII.—Oxides of Nitrogen.

In the combustion of coal gas in a flame nitrogen oxides are produced and of these nitric oxide, which is converted to nitrogen peroxide on mingling with the air, needs consideration in view of the possibility of irritant action on the respiratory tract.

It has been shown that for every part of carbon dioxide produced in the combustion of ordinary coal gas 0·001 part of nitrogen peroxide is produced as a result of the combination in the flame of oxygen and nitrogen.[17] The temperature of the flame and the flow of air through it determine the actual amount of the peroxide produced, but the above-mentioned figure is a reliable basis on which to assess its quantitative significance. Suppose, for example, that as a result of the combustion of gas in a flueless heater the concentration of carbon dioxide in the air of a room rose to 1% then the nitrogen peroxide present in the air would be approximately 0·001% or 10 parts per million. It has been established that the maximum allowable concentration of nitrogen oxides for prolonged exposure is of the order of 0·0039%.[42, 43] Hence, even with as high a carbon dioxide percentage as 1, which would only be reached under conditions of minimum air change and gross overheating, the concentrations of nitrogen oxides will be approximately one quarter of the percentage allowable for prolonged exposure.

IX.—Oxides of Sulphur.

It has already been stated that in the normal combustion of coal gas small quantities of the oxides of sulphur are produced; the actual amount being governed by the sulphur content of the gas. Gas used for domestic purposes may contain 10, 20, or even as much as 30 grains of sulphur per 100 cu.ft., according to the process of manufacture. It follows from this that gas appliances of identical design and operated at the same gas rates would produce widely different quantities of sulphur oxides according to the gas supplied. This fact makes it necessary to specify the sulphur content of the gas as well as the size of the room and the air change in any recommendation regarding the permissible gas rates for flueless appliances.

Both sulphur dioxide and sulphur trioxide are present in the products of combustion of coal gas, and of the mixed gases the trioxide will rarely reach 20%. They are very soluble gases and when they come in contact with the moist tissues of the upper respiratory tract they enter into solution and cause irritation if the concentration is sufficiently high. Before irritation is produced the gases are perceptible to the sense of smell and, therefore, if the permissible concentration of these gases is based on the minimum percentage perceptible to normal people, both health and comfort will be adequately safeguarded.

In industrial work the maximum concentration of sulphur dioxide allowable for prolonged exposure has been placed at 0·001%.[43] At concentrations higher than this, irritation of the throat and coughing result, and the atmosphere becomes unendurable.

There is no evidence that harm can result from prolonged exposure to small concentrations of sulphur oxides corresponding to the threshold of smell, and it is on record that workers continuously exposed to atmospheres containing amounts of sulphur dioxide sufficient to give a distinct odour show no signs of impairment of health.[44] The presence of sulphur trioxide becomes perceptible in concentrations as low as about 0·00002%. The threshold concentration for sulphur dioxide is about ten times greater or 0·0002%. For the combined oxides, therefore, the threshold of perception is of the order of 0·0001% or 1 part per million.[12]

The Committee considers that the chief importance of the sulphur oxides in this connection is their objectionable smell and not their effect upon health. It recommends therefore as a desirable limit for the concentration of the combined oxides of sulphur a figure of 0·0001%, at which level these oxides are still imperceptible to smell. This will allow a wide margin of safety because, when this limit is ensured by adjustment of the gas rate of the appliance and the air change in the room, the concentrations of the other products of combustion—viz., carbon monoxide and the oxides of nitrogen, will be insignificant.

It has already been pointed out that the walls and furnishings of a room absorb a substantial amount—50-75% of the sulphur oxides liberated by the combustion of coal gas.[12]

This absorption permits a higher gas rate and consequent heat supply than would be permissible if the room air retained the whole amount of the sulphur oxides produced. On the basis of the limiting permissible concentration of 0·0001% and a 50% absorption of sulphur oxides by walls and furnishings, the appropriate gas rates for gas of varying sulphur content have been calculated and set out in Table I. for a room of 500 cu.ft. capacity with an air change of 1½ per hr.

TABLE I.—*Maximum Gas Rates for Flueless Appliances in a Room of 500 Cu.Ft. Capacity and 1½ Air Changes per Hour.*

Sulphur Content of Gas per 100 Cu.Ft.	Gas Rates.	
	Continuous Use.	Intermittent Use.
Grains.	Cu.Ft. per Hour.	Cu.Ft. per Hour.
10	9	18
20	4·5	9
30	3	6

It has been pointed out above that a top storey room of 500 cu.ft. capacity with two outside walls could be adequately warmed in cold weather by a flueless gas heater consuming 5 cu.ft. of gas per hour. Thus, for use in such a room, gas of 20-grain or 10-grain sulphur content would be satisfactory, but 30-grain gas burnt at the same rate would produce a perceptible smell of sulphur oxides which might be deemed a nuisance. The concentration of the sulphur oxides, however, would be unlikely to affect health, as the permissible limit of 0·0001% allows a wide margin of safety. If the domestic gas supply contains 30 grains of sulphur per 100 cu.ft. it would be advisable to use flueless heaters designed to give out radiant heat so that by direct radiation an adequate warming effect could be produced at a lower gas rate. It has been stated that increased ventilation has only a small effect on heating requirements although the concentration of products varies inversely with the ventilation. The use of gas heating appliances unconnected with a flue as the sole means of maintaining comfort conditions throughout a room is undesirable when the sulphur content of the gas exceeds 30 grains per 100 cu.ft.

Air Vitiation Summary.

The main factors determining the vitiation of room air by the products of combustion of gas burnt in flueless heating

* In order to avoid any possible misunderstanding as to the term "chronic carbon monoxide poisoning" in this section of the Report, the Committee desire to state that it is used solely according to the definition given in the text, and distinct from any of the recognized after effects, either temporary or permanent, of acute or subacute poisoning from single or repeated toxic doses of the gas.

appliances have been dealt with separately under the several headings of carbon monoxide, nitrogen oxides, and sulphur oxides. It is necessary, however, to correlate the recommendations as to the concentrations of these products which are permissible on grounds of health and comfort so that the gas rates specified for use will at one and the same time ensure that each significant product of combustion will not exceed its allowable concentration.

Table II. specifies the gas rates recommended for continuous domestic heating by flueless heaters in rooms in which the air change varies from ½ to 3 per hr., provided the sulphur content of the gas does not exceed 20 grains per 100 cu.ft.

TABLE II.—*Maximum Gas Rates for 20-Grain Sulphur Content Gas Burnt Continuously in Flueless Heaters in Rooms of 500 Cu.Ft. Capacity, Together with the Resulting Concentrations of Products of Combustion in the Air of the Room.*

—	Gas Rate, Cu.Ft. per Hour.	Sulphur Oxides, Assuming 50% Absorption.	Carbon Monoxide.	Nitrogen Oxides.
		%	%	%
½ air change per hour	1·5	0·0001	0·0006	0·0003
1 " " "	3	"	"	"
1½ " " "	4·5	"	"	"
2 " " "	6	"	"	"
3 " " "	9	"	"	"

It is obvious that with gas of a lower sulphur content higher gas rates could be employed, for the concentrations of carbon monoxide and nitrogen oxides are shown to be approximately one-tenth of the maximum concentrations of these gases deemed harmless for prolonged exposure.

BIBLIOGRAPHY.

1 Aldrich, L. B. "A Study of Body Radiation." Smithsonian Misc. Coll., Vol. **81**, No. 6, December, 1928.
2 Martin, C. J. "Thermal Adjustment of Men and Animals to External Conditions." *The Lancet*, Sept. 13, Vol. **20**, p. 27, 1930.
3 Fishenden, M. Fuel Research Board Report, "The Heating of Rooms," No. 12, 1925. H.M. Stationery Office.
4 Vernon, H. M. "The Principles of Heating and Ventilation," 1934. Arnold & Co., London.
5 Houghton and McDermott. "Heating, Piping, and Air Conditioning," January, 1933.
6 Hartley, H. J. of Inst. of Fuel, August, 1934.
7 Killick, E. M. J. of Hygiene, 1932, Vol. **32**, pp. 332-339.
8 Liese, W. Deut. Med. Woch, 1933. Vol. **59**, pp. 1172-3.
9 Miura, U. Amer. Journ. Hygiene, 1931, Vol. **13**, pp. 432-459.
10 New York State Commission on Ventilation Report, 1923.
11 Report on School Ventilation, 1931. New York State Commission.
12 Masterman, C. A., Dunning, E. W. B., and Densham, A. B. "Air Vitiation and Gas Appliances." Trans. I.G.E., Publication No. 116, 1935.
13 Yaglou and Others. "Heating, Piping, and Air Conditioning." J. of American Society of H. and V. Eng., 1936, pp. 65-76.
14 Haddow, F. S. H. and V. Eng., 1929, p. 57.
15 Masterman, C. A., and Dunning, E. W. B. "Combustion Standards of Gas Appliances." Trans. I.G.E., 1931-32, Vol. **81**, p. 142.
16 Technical Data of Fuel. (Edited by Spiers.)
17 Wood, J. W. "Examination of the Products of Combustion from Typical Gas Appliances, Part VI, Oxides of Nitrogen." 28th Report of the Joint Research Committee. Trans. I.G.E., 1931-32, Vol. **81**, p. 66.
18 Rideal, S. "The Relative Hygienic Values of Gas and Electric Lighting." J. of the Royal Sanitary Institute, 1908, Vol. **29**, pp. 49-132.
19 Smithells and Ingle. Trans. Chem. Soc., 1892, Vol. **61**, p. 204.
20 "Combustion of Flames." Trans. Chem. Soc., 1912, Vol. **101**, p. 846.
21 Trans. Chem. Soc., 1906, Vol. **89**, p. 652.
22 Trans. of Institution of Gas Engineers, 1925-26, p. 141.
23 Lacey, S., and Masterman, C. A. "National Policies Governing the Testing of Gas Appliances." Publication No. 109/14, I.G.E., 1935.
24 Report to the Board of Trade of the Departmental Committee on Deaths from Gas Poisoning, 1930.
25 Haldane, J. S., and Priestley, J. G. "Respiration." Clarendon Press, Oxford.
26 Barcroft, J. "The Respiratory Function of the Blood." London, Mills and Boon.
27 Haldane, J. S. "The Investigation of Mine Air." London, Charles Griffin & Co., 1905.
28 Frederick, R. C. "Ventilation Conditions, Normal and Abnormal." The Inst. of Chem. of Gt. Britain and Ireland, 1929.
29 Haldane, J. J. of Physiol., 1895, Vol. **18**, p. 430.
30 Henderson, Y. J. of Industrial Hygiene, 1921, Vol. **3**, p. 79.
31 Sayers, Meriwether, and Yant. U.S. Public Health Report, 1922, Vol. **37**, p. 1,127.
32 Nicloux, M. Ann. d'Hyg. Pub. Indust. et Sociale, 1926, Vol. **4**, p. 637.
33 Campbell, J. A. J. of Physiol., 1929, Vol. **68**, p. 81.
34 Haldane, J. S. "Carbon Monoxide Poisoning" Transactions of the Medico Legal Society, 1930, Vol. **24**, p. 162.
35 "Physiological Effects of Automobile Exhaust Gases," J. of Industrial Hygiene, 1921, Vol. **3**, p. 79.
36 Killick, E. M. J. of Physiol., 1936, Vol. **87**, No. 1, p. 41.
37 Glaister, J., and Logan, D. Gas Poisoning in Mining, &c., N.Y., 1914, p. 311.
38 Petersen, Harries, and Webster. Legal Medicine, N.Y., 1923, Vol. II., p. 267.
39 Sayers et al. U.S. Public Health Reports, No. 186, 1926, p. 58.
40 Jacksch Vergiftungen. "H. Nothnagel, specielle Pathologie and Therapie." I. Band, 1910 p. 267.
41 Haldane, J. S. Journ. Inst. of Heating and Ventilating Engineers, 1936, Vol. **4**, No. 37, p. 18.
42 Lehman, K., and Hasegawa. Arch. f. Hygiene, 1913, Vol. LXXVII., p. 323.
43 Henderson, Y., Haggard, H. W. Noxious Gases, 1927, pp. 134–136.
44 Kennon, B. R. Journ. of Industrial Hygiene, 1927, Vol. **9**, p. 486.

Scottish Eastern Juniors

Visit to Messrs. Alder & Mackay, Ltd., Edinburgh

There was a large attendance of members of the Scottish Junior Gas Association (Eastern District) on Saturday, Jan. 9, when the New Grange Works of Messrs. Alder & Mackay, Ltd., Edinburgh, provided the venue of an interesting and instructive inspection of modern meter-making machinery and methods.

Members were guided through the various departments and saw most of the necessary operations of manufacture and assembly being performed. Most of the light metal parts are pressed out by machine, but a certain amount of casting is also done and machines for this purpose have been introduced in addition to the hand method. A tilting gas-heated furnace adds greatly to the efficiency of this department, allowing a greater number of runs per day than was possible formerly. The 100 cu.ft. per hour H.C. iron case was a good example of casting and one was seen being ground on a horizontal grinding wheel. The casting of white-metal parts was demonstrated, the valves so produced being afterwards ground on three grades of stone to produce the required surface before being assembled in the meter. The excellent quality of the bellows skins was commented on, and the apparatus for their testing examined. The skins were seen being stitched by machine, also their subsequent treatment with oil for preservation when they had been attached to the pans by machine.

Assembly and testing of optional-payment and ordinary prepayment mechanisms furnished an opportunity of appreciating the thought that has gone into the design of these ingenious units. Ordinary and direct-reading indexes were seen in process of assembly. The building of the cases showed the soldering craft of the tinsmith, while the adjusting and setting of the valve-mechanism and indexes gave a real insight into the construction of gas meters.

Members were conveyed by 'bus to the Royal British Hotel for tea, where Mr. J. L. Bennet presided over a gathering of more than a hundred. In a speech of welcome, Mr. Bennet stated that this was a record number for a visit of this sort to their works. It gave his firm great pleasure to have the Juniors with them and they hoped that the visit had proved of value to everyone. He was pleased to see so many Seniors present. His firm made use of gas as much as possible for lighting, heating, and power, their annual consumption of gas amounting to 7 million cu.ft. They introduced the latest machinery in order to speed up production. This was necessitated by the great increase in the cost of raw materials, of which he gave several instances. These materials came from world-wide sources, and this fact provided the theme for the new form which their advertising displays would take. These promise to be of special interest.

Mr. James M. Dow, President of the Eastern Juniors, thanked Mr. Bennet for the welcome and hospitality given and asked him to convey these thanks to the Board of Directors. The Juniors found new interests each time they visited New Grange Works and had thoroughly enjoyed the privilege of seeing the works that day. Mr. Dow welcomed the presence of the Seniors to whom Juniors looked for guidance in many ways.

Mr. William Wilson, a Past-President of the Western Juniors, in a witty reply for the Seniors, drew attention to the great improvement in methods of meter manufacture and stressed the high standard of the products of Alder & Mackay, whose motto was, and always had been, "Quality First."

Review of the General Meeting of the Union Syndicale de l'Industrie Technique du Gaz en France

(*Continued from p.* 102.)

Flexibility of Continuous Vertical Retorts

Investigations conducted on a setting of 56 103 in. Woodall-Duckham continuous vertical retorts at Gennevilliers were described by M. Besson. The work was carried out on a single retort of the setting, the retort being equipped with its own foul main and with the necessary devices enabling all essential weights and volumes to be measured. In order that the coke yield might be obtained in a reliable manner, water quenching in the coke chamber was eliminated. A stock of ¾ in.-1½ in. Pas de Calais coal sufficient for the programme of tests was specially segregated and was handled without difficulty.

At any throughput, vertical retorts may be operated at a relatively low or a relatively high temperature. Tests were carried out with throughputs of 9 and 6·5 tons of coal per retort per 24 hours, with rates of steaming equivalent to 5, 10, and 20% of the weight of the coal and, in the case of the tests at high throughput, according to two different temperature schedules. In each series of tests the temperature was varied in linear relation to the percentage steaming. This point must be borne in mind in connection with what follows.

Detailed results for all the tests were presented and, to afford an index of comparison, the results of straight carbonization of the coal in inclined chambers were included.

The thermal efficiency of water gas production in vertical retorts was found to depend on the operating conditions and on the amount of steaming, a more or less sharply defined optimum being obtained for a particular degree of steaming. From the mere aspect of thermal efficiency of water gas production, it was found that the optimum amount of steam was 6% on the coal at a throughput of 6·5 tons per retort per 24 hours and 10% at a throughput of 9 tons per retort per 24 hours. With intermediate throughputs the optimum amount of steaming bears a linear relationship to the throughput. With a high temperature schedule the optimum efficiency at a throughput of 9 tons per retort per 24 hours was in the neighbourhood of 14% of steaming.

The therm production per retort per day could be altered in the ratio of 1 : 1·8, the two extremes representing a throughput of 6·5 tons with 5% steaming and 9 tons with the high-temperature schedule at 20% steaming.

A comparison of the net cost of gas production per therm (cost of coal less residuals) under conditions prevailing at Gennevilliers showed that, at low rates of steaming, the cost of gas is virtually independent of the throughput of the retorts. At high rates of steaming, conditions are in favour of high throughputs. Except in the case of low throughputs, the lowest cost of gas is obtained when high steaming is practised—*i.e.*, when the rate of therm production per retort per day is at a maximum.

At a works such as Gennevilliers, where several types of gas making plant are available, an investigation such as the present one enables the operating conditions to be adjusted in relation to seasonal gas demands and market conditions with a view to the production of the cheapest therm. For example, it may sometimes pay to produce gas of high calorific value from the vertical retort installation and to supplement it with water gas from an external generator whereas, at other times, the best course would be to produce a gas of lower calorific value from the retorts. In this connection it may be noted that the vertical retorts at Gennevilliers were operated at throughputs ranging between 6 and 10 tons per retort per day in 1933 and between 6·4 and 9·3 tons per retort per day in 1934, the steaming being varied between the limits necessary for the production of gas having calorific values ranging from 450 to 505 B.Th.U. per cu.ft.

(*To be continued.*)

PART 2

Domestic Utilization of Gas

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Technical Editor, "Gas Journal" and "Gas Salesman"; Editor of the "Gas Salesman's Pocket Book."

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In common with its forerunner, Part 2 of "Domestic Utilization of Gas" is noteworthy for the Authors' originality of approach, facility of expression, and, above all, intimate knowledge of the problems which confront the gas salesman. *Part 2 of "Domestic Utilization of Gas" is a corollary to, and in no way a revision of, Part 1*; and its teaching carries on along lines of knowledge which in recent years have become essential to everyone concerned with the distribution and sale of gas and gas appliances.

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NOTE. PART 1.—A Third Impression is in the press and will be ready in a few weeks.

THE DEVELOPMENT OF

A Gas Amalgamation

by
W. M. GLEDHILL
(Assistant Engineer & Manager, Stirling Gas Light Company)

From a Paper read before Members of the Scottish Junior Gas Association (Western District) at a meeting held at Glasgow on Jan. 9—Mr. JOHN WEBSTER (Port Glasgow), the President, in the Chair.

The amalgamation of gas interests with which this Paper is concerned are those of the Stirling Gas Light Company and of the Burgh of Bridge of Allan, a striking feature in this case being the absorption of a municipally owned undertaking by a privately owned body—a Statutory Company. Obviously many obstacles had to be overcome before the possibility of amalgamation could be accepted by the Town Council, since considerable local antagonism was displayed towards the scheme in its early stages. Actually the scheme had been conceived over 35 years ago when the Bridge of Allan Gas Light Company found it necessary either to reconstruct their entire works or build a new works at another site owing to the limitations of the old works dating from 1871, and to the increased demand due to the rapid development of gas for heating and cooking purposes.

In 1903-04, on the advice of their Engineer, it was deemed advisable to construct a new works; and since the annual output was in the region of 25 million cu.ft. per annum, a new works was laid down adjacent to the main railway line, with ample provision to meet their requirements and capable of being easily increased to meet a load of 60 millions. I might add that the lay-out of this works was of a high standard and could be regarded as a model in that respect.

To meet the cost of this new works a sum of £10,000 was borrowed, the selling price of gas was 3s. 6d. per 1,000 cu.ft. for many years, but subsequently had to be increased.

At this time (1903) the Stirling Company made an offer to purchase the Bridge of Allan undertaking and supply gas from Stirling; but the Bridge of Allan Town Council opposed the transaction since they were of the opinion that it was not for the good of their community. The Stirling Company had intended to charge an additional 5d. per 1,000 cu.ft. in the new district over the Stirling price, which was 3s. per 1,000 cu.ft.

In 1913, the Bridge of Allan Town Council decided to negotiate for the purchase of the local gas undertaking, and finally the transfer was subjected to arbitration to determine the price, which was subsequently fixed at £29,453 or an equivalent of £1,100 per million cu.ft. made.

Under the Town Council control, the Gas Undertaking continued to make a little progress, but owing to the stagnation of the resident population, and the effect of the war, the anticipated increase in gas sales did not materialize, resulting in the price of gas being raised to meet the heavy capital charges and the increasing costs of raw materials. This state of affairs continued for some time, and the price of gas rose to 8s. 4d. per 1,000 cu.ft., or 1s. 8d. per therm, this price being applicable to both ordinary and prepayment consumers. In addition it became necessary to levy a Gas Contingency Rate of 6d. to assist the finance of that Department.

In 1932 the Stirling Company modernized the entire gas manufacturing plant, making ample provision for future expansion. At the same time the Bridge of Allan Council was again approached with a view to purchasing their gas undertaking, a sum of £23,000 being offered, but once again negotiations broke down.

From 1932 to 1934 it was found possible to reduce the price from 1s. 8d. per therm to 1s. 4d., or 6s. 8d. per 1,000 cu.ft.; but this attempt to curtail the gradual decline of gas consumption did not receive the support it merited, resulting finally in the public demanding that negotiations with the Stirling Company be re-opened for the disposal of the Gas Undertaking.

It will be readily appreciated that during the foregoing critical years every economy had been practised by the Bridge of Allan management, with the result that most parts of the plant required extensive overhaul, their useful life being almost at an end. The Town Council were thus faced with heavy replacement charges and a relatively higher charge for gas, purchase of gas by bulk supply, or disposal of the Undertaking with an immediate reduction in the price of gas to the local gas consumers. Thus in 1934 negotiations were re-opened—this time by the Bridge of Allan Town Council, who appointed experts to investigate and report on the technical and financial aspects of their Undertaking. Meanwhile the Stirling Company proceeded to make the necessary arrangements for amalgamation.

Statutory Obligations Involved.

Under the provisions of the Gas Regulation Acts it is necessary in the case of a statutory company, when contemplating a financial deal of this nature, to notify all shareholders and local authorities of their intentions, and receive their assent before negotiations can be actively commenced. Thus, an Extraordinary General Meeting of shareholders was held on Jan. 7, 1935, to approve of an Agreement between the Stirling Gas Light Company and the Bridge of Allan Town Council for the acquisition of the Bridge of Allan Gas Undertaking.

The main features of the agreement concerning the purchase-offer of £15,500 were as follows:

(1) All lands, including gas-works site, &c., to the extent of 21 acres.
(2) The entire works, including dwelling-houses.
(3) Both parties to obtain Provisional Orders.
(4) The gas rates in Bridge of Allan district not to exceed the Stirling rates by more than 3d. per therm.
(5) Defined limits of the district supplied with gas.
(6) All mains, meters, and apparatus in consumers' premises.
(7) All stocks of a guaranteed value.
(8) The lease of the showroom.
(9) Guarantee to use gas exclusively for street lighting for a period of ten years from the date of amalgamation.
(10) The gasholder to be guaranteed in a state of good repair.

It will be noted that the public lighting service and all liquid assets are excluded from the sale.

This agreement satisfied the demands of both parties, who then commenced the preparation of their respective Provisional Orders.

The Stirling Gas Light Company is a statutory standard price company incorporated under the provisions of the Stirling Gas Act, 1898, amended by the Stirling Gas Order and Gas Orders Confirmation (No. 3) Act, 1904, the Stirling Gas (Charges) Order, 1921, and the General Acts appertaining to the operation of gas companies.

A Special Order was then drafted embodying the necessary powers and the opportunity taken to revise the financial structure of the Company and to repeal obsolete clauses of the 1898 Act and the Order of 1904. The Company thus sought powers to acquire the Bridge of Allan Town Council Gas Undertaking, to extend the present limits of supply, and to raise the necessary capital for the purchase, by borrowing or otherwise.

A further Extraordinary Meeting of the shareholders was called to approve of the draft Order on March 11, 1935, it being essential to obtain approval by a majority of persons, voting in person or by proxy, who represented not less than three-quarters of the paid-up capital of the Company.

After preliminary negotiations with the Scottish Office and Board of Trade, owing to the peculiar nature of the transfer from municipal to private ownership, application was made to the Board of Trade for the Order on April 12, 1935. Final confirmation was obtained on Dec. 21, 1935, the Special Order entailing a cost of £1,000 approximately.

The Bridge of Allan Order was submitted and approved during the above period.

The Bridge of Allan Works was equipped with stop-end horizontal retorts, and a "Simplex" water gas plant utilized chiefly for peak loads. The declared calorific value of the gas was 500 B.Th.U., and since that of Stirling was 440 B.Th.U., provision for alteration to the lower value had to be made. Normally it is necessary to give not less than three months' notice of the proposed change of calorific value and to declare the new value, but owing to the urgent

nature of the transfer a clause was inserted in the Order which allowed for the revised calorific value to operate from the date of take-over.

Final Arrangements and Change Over.

The official date of the transaction took place on Jan. 15, 1936, three-and-a-half weeks after the Special Orders had been granted—the Stirling gas being turned on officially by the Interim Chairman of Directors. On the previous day inventories of all stocks at works and showrooms were taken and their value assessed jointly by the Bridge of Allan Council's technical adviser and a representative of the Gas Company. In connection with this it is interesting to note that the gas stock at the time of transfer was sold to the Company at the new rates, being calculated proportionately for ordinary and prepayment consumers after deducting for unaccounted-for gas.

Owing to the uncertain state of the coal industry, a good stock of coal had been maintained at the Bridge of Allan works; also, in order to pick up the load gradually at Stirling during peak load, gas making was continued for two weeks until coal stocks were exhausted. This period was of additional assistance, since a considerable drop in calorific value had to be made—*i.e.*, from 500 B.Th.U. to 440 B.Th.U.—and by gradually increasing the amount taken from the feeder main during this period, the change was achieved without undue trouble to consumers. On the cessation of gas manufacture at the Bridge of Allan Works the station meter inlet main was disconnected and the new connection made to the feeder main, all gas being measured into the holder from this time.

A dual meter survey by two Burgh Council inspectors and two Stirling inspectors commenced a week before the date of transfer in order to equalize the number of meters being surveyed before and after this date. A gas-fitter accompanied both parties, and an inventory of consumers was obtained, with details of services and appliances, the necessary adjustments being made to all fittings and the prepayment meters reset to give effect to the new rate.

Since the existing workshops in the works were too far from the centre of the town to be economically useful, they were dispensed with. We were fortunate to secure in the centre of the town, within a short distance of the showroom, suitable premises, which were immediately converted into a fitting shop and stores and have since proved invaluable. Previously the major part of the gas fitting was in the hands of local tradesmen and was generally an unsatisfactory state of affairs. The distribution work was rearranged and a selected staff under a leading fitter now operates in this district, resulting in improved service to consumers.

Public Lighting.

The street lighting in the Burgh of Bridge of Allan was controlled entirely by the Council Lighting Committee and Gas Department and consisted of 225 lamps which had been excluded from the sale, being retained as a public service. The lamps were operated by a pressure wave system induced at the works in the station governor outlet main by a steam injector.

The retention of this system had been an ever present problem during negotiations of the amalgamation, and I do not intend to describe the merits or disadvantages of the pressure wave system, which if retained would have required either steam-raising plant operating during the lighting season or some form of automatic booster at the works.

At the time of the transfer, half-way through the lighting season, it was decided to continue the existing arrangements for the duration of that period. The works boiler was thus maintained under steam, which was additionally used for thawing the holder tank water, and entailed the labour charges of two watchmen on 12-hour shifts, who also controlled the holder stock. This method was obviously too expensive to continue with, and the installation of an automatic booster would have cost approximately £150; so we therefore decided to dispense with the pressure wave system at the first favourable opportunity.

The Town Council, who had guaranteed to use gas exclusively for street lighting for a period of ten years, requested the Gas Company to submit a tender for the maintenance and lighting of their public lamps. A scheme was prepared and tender submitted in which we proposed to convert the pressure wave system to clock control, the burners were to be fitted with constant pressure governors, and would be lighted and maintained by us. The price of gas supplied for this purpose was reduced by allowing a 10% discount off the price ruling in the district, and the contract received the approval of Council.

The work of fitting clock controllers and governors was proceeded with during the summer of 1936, all burners being overhauled and in many cases renewed, the opportunity being taken at this time to improve the lighting by fitting reflectors of the directional and "multi-ray" pattern, both above and below the light source. A Bridge of Allan employee was taken over and is responsible for the entire lighting system, together with the pumping of syphons.

The local showroom and sales system were completely re-organized, the local saleswoman being retained under the control of the main sales department. Recently a series of cookery demonstrations were given, thus stimulating public interest and resulting in very satisfactory sales and enquiries for appliances.

Owing to the absence of statistics relative to the Undertaking prior to amalgamation, and also to the fact that we have not had control for a period sufficiently long to provide a true comparison of results, I do not propose to enlarge thereon.

It has been self-evident that the immediate reduction in price from 1s. 4d. per therm (6s. 8d. per 1,000 cu.ft.) to 11d. per therm (4s. per 1,000 cu.ft.), the improvement in composition, specific gravity, and naphthalene content of the gas, the absence of pressure wave, the advantages due to our sales policy, and improved service, have been appreciated by the community as a whole.

The anticipated results of the amalgamation have thus so far proved entirely satisfactory to both parties, and although a considerable amount of work has yet to be done to ensure a successful issue, it is encouraging to find the consumers responding to the efforts that have been made to further the interests of the Gas Industry in this locality. Our ambition is to develop and encourage the use of gas in this district to such an extent that it will be possible to reduce the charges as soon as possible to the scale operating throughout the remainder of our area of supply.

Discussion.

The PRESIDENT (Mr. J. Webster, Port Glasgow) said that amalgamations were very much in the forefront of the Industry at the present moment; but amalgamation just for the sake of amalgamation was not worth while. In the case of the Stirling amalgamation, it was apparent that many problems had to be overcome and he was interested in the schemes which had been considered. He asked how Mr. Gledhill dealt with the holders during the winter to prevent them freezing up.

Mr. POULSON (Glasgow) observed that he was pleased to know that a campaign for the re-organization of the sales had taken place which would be to the benefit of the community. On many occasions he had found the crowns of holders badly perforated, and this was a source of leakage. The drop in calorific value from 500 to 440 B.Th.U. might not have the same detrimental effect as would be supposed at first sight, because in small works the calorific value was more liable to fluctuations than in a larger undertaking. It was also of interest to note that the trunk main could cope with additional load in the future.

Mr. DAVIES (Alexandria) remarked that there was at the moment a movement on foot by his Corporation to supply the Dreghorn Gas Company in bulk, through two miles of 4 in. main. The difficulties appertaining to the change in calorific value would require to be overcome, as also would the smallness of the old mains and services. Did Mr. Gledhill experience much difficulty in the mains and services being too small when his Company took over Bridge of Allan?

Mr. R. A. MCLAREN (Newton-on-Ayr) said Mr. Gledhill mentioned that his Company had used the Stanton-Wilson joint in their pipe line, and he would like to say that at the moment he was laying 5,000 yards of high-pressure steel main and was continuing the use of lead joints. While Mr. Gledhill had dealt fully with the technical side of the business, he had not said very much about the personal side. Were all the employees of the Bridge of Allan Gas Company absorbed when the change over took place? He had noted, however, that they had taken into their employment the lady attendant in the showroom and one fitter.

Mr. E. G. SMITH (Dumbarton) suggested that holding companies buying small gas undertakings did not have the interest of the consumers at heart. He would like to know if Mr. Gledhill's Company encouraged the co-operation of the local plumbers. They had found this policy most beneficial at Dumbarton, and knew of other places where this co-operation had met with marked success.

Mr. J. BATEMAN (Kilmarnock) noted that the district pressure had been increased to 7·5 in., and asked if this was not unduly high. Also, could Mr. Gledhill state what effect this high pressure would have on the unaccounted-for gas.

Mr. D. FULTON (Helensburgh) remarked that many companies must amalgamate or become defunct, and in this case Bridge of Allan would have died, and great harm would have been done to the Industry if this had been allowed. The output at Bridge of Allan had dropped about one-third, and no one could uphold a case for Bridge of Allan holding out against the amalgamation. In this case, the amalgamation had a threefold ad-

vantage—namely, the consumer, the Gas Industry, and the Gas Company would all benefit. These advantages would not always apply in a simple holding company owing to geographical conditions, but in this case it was so. It was evident that great care and consideration had been given to the method of taking the gas to Bridge of Allan, and it was a great advantage to utilize the holder to equalize the district pressure. To his mind the moral of this Paper was: "Prepare thoroughly the scheme before putting it in operation."

Mr. FRAZER (Glasgow) said he was not conversant with the lie of the land at Stirling, but suggested that the line of pipe should have been by the main road and not by a railway embankment. What did they expect to get from this pipe in the future in comparison with the main road scheme? Any scheme which necessitated the use of a booster must be avoided because of the standing and running charges.

The Author's Reply.

Mr. GLEDHILL, in reply, said that since the works at Bridge of Allan had been shut down and a portion had been sold they had had to remove the boiler, and at the moment they had no means of preventing the holders freezing up. Stirling gradually lowered the calorific value in order that the number of complaints would be minimized, and these were dealt with by putting the full staff of plumbers on the district for a few days after the change over. Of the actual number of employees at Bridge of Allan, only two were not absorbed, as these men had already found other employment.

It was obvious that this amalgamation would be to the advantage of the consumers at Bridge of Allan, and as a result of what had been done in the way of maintenance, service, and re-organization of the sales campaign during the last six months £500 worth of sales had been made. The unaccounted-for gas in previous years had been around 13-14%; but they hoped to make improvements here by overhauling the mains and supplying governors to lamps. The plant at Bridge of Allan was definitely in a bad state—for instance, the Livesey Washer was not functioning; two sections of the condensers had been cut out because of corrosion; a 12 in. main had the diameter reduced to 6 in. because of naphthalene. Regarding Mr. Frazer's remarks on the main road, Mr. Gledhill pointed out that this was not as much a main road as a secondary road, and the possibilities of development were very small; also there were too many twists and bends in the road which would have resulted in a great loss of pressure if the main had been laid there.

Trade Notes

Scottish Sales Manager for Clough (Croydon), Ltd.

Messrs. Clough (Croydon), Ltd., have appointed Mr. E. V. Craig, of 90, Nuirfield Crescent, Dundee, Angus, as their Sales Manager for Scotland. Mr. Craig has a large and varied experience of engineering and is well-known throughout Scotland.

Automatic Controls and Recording Instruments.

The firm of Honeywell-Brown, Ltd., has been established at 70, St. Thomas Street, S.E. 1, as a factory branch of the Minneapolis-Honeywell Regulator Company and the Brown Instrument Company, which form one of the largest automatic control instrument concerns in the world. We have received from Honeywell-Brown, Ltd., a copy of their latest catalogue, which describes and illustrates a wide range of automatic controls and recording instruments supplied by the firm, many of which may find useful applicatio n in various processes connected with the Gas Industry.

Tecalemit Appointments.

Promotions to the Board of Directors of Tecalemit, Ltd., were announced on Jan 7, by confirmation of the respective appointments of Mr. W. J. Parslow (General Manager) and Mr. A. Sewell (Sales Manager). Both gentlemen concerned have had considerable experience within the organization, the former practically since the inception of the business.

It is understood that there will be no immediate appointment of successors to the executive posts previously occupied, as the new Directors will continue to carry out the duties concerned in each case.

The "R.T." Room Thermostat.

Reference was made in these columns on Jan. 6 to the new "R.T." type room thermostat recently designed by the British Thermostat Company, Ltd., of Sunbury-on-Thames. The makers now announce that the maximum switch capacity of this instrument has been increased to 15 amperes at 250 volts A.C., which will permit the direct control of heating loads up to from three to four kilowatts. A new catalogue has just been issued by the firm dealing with their "Teddington" hydraulically-operated motorized valves, the final operating force of which is hydraulic pressure generated by an electrically driven oil pump.

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4	4
6	6
7	7
8	8
9	9
10	10
12	12

Vertically Cast Iron Pipes

9 Feet Lengths	12 Feet Lengths
DIAMETER	DIAMETER
ins.	ins.
3	—
4	4
6	6
8	8
9	9
10	10
12	12
	15
	18
	24

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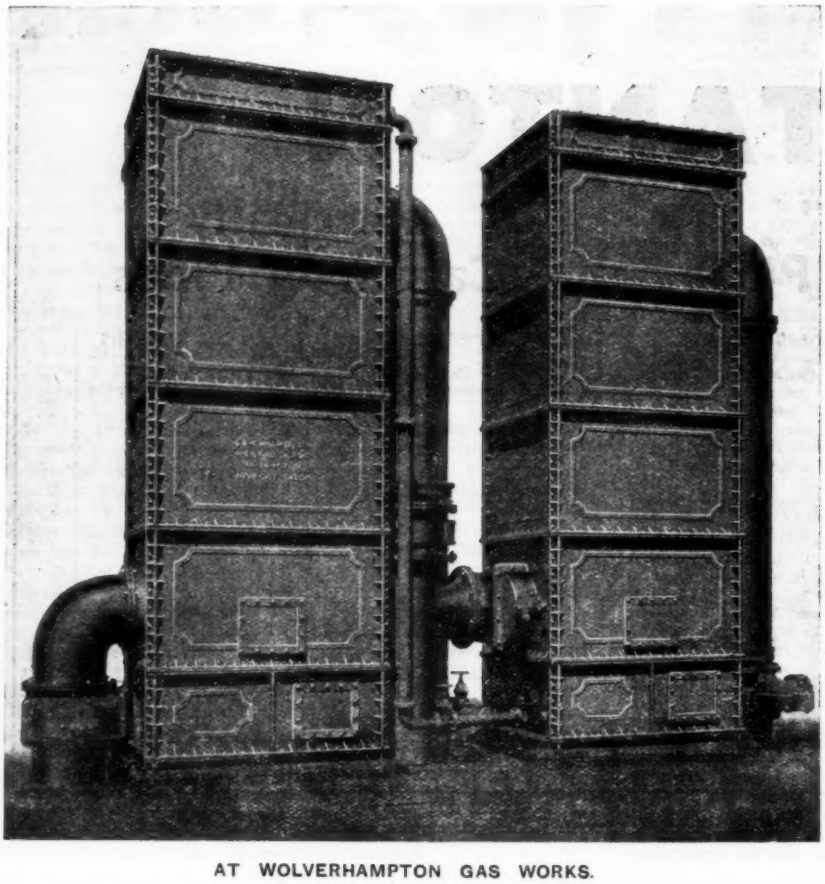

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Gas Markets and Manufactures

Stock Market Report

(For Stock and Share Lists, see later pages)

Business on the Stock Exchange for the most part of last week was good generally, but with the close of the Account on Friday, a large amount of profit-taking took place and the tone became dull. In the absence of support gilt-edged stocks experienced a further set-back, though this is not unusual at this time of year when funds are required for income-tax payments. Home rails also reacted on the poor traffic returns, while business in industrials tailed off and prices, with the exception of a few specialities, became irregular. The oil and mining markets were the centres of attraction, but most of the improvement in values was discontinued on profit-taking. The underlying conditions, however, remain firm, and with the opening of a new Account some recovery is anticipated.

The Gas Market continued unperturbed by the general dullness and the volume of business was well up to the usual proportions. In contrast to some sections prices tended to harden, though only a few quotations were moved up. In the London List, the most prominent recovery was that of Imperial Continental, which closed 8 points higher at 157½. South Metropolitan improved again with a rise of 1½ to 119½, and East Hull hardened a similar amount to 111. At the Provincial Exchanges, it will be seen that Blyth ordinary, which made a sharp rise of 11 points a few weeks ago, hardened a further 2 to 167, but Newcastle units eased another 3d. to 26s. 6d.

The next item of interest to gas investors will be the final dividend announcements for the past year, and doubtless by the time this Report is published several of these will be known. To what extent the general improvement in trade will have affected profits remains to be seen, but it must not be forgotten that the Industry has had to meet heavy additional expenditure on coal and wages during the year, and only a small proportion of these extra costs has been passed on to the consumer. Economies in other directions have doubtless been made, however, so that in the majority of cases the previous year's rates will probably be maintained.

Current Sales of Gas Products

The London Market for Tar Products.

Jan. 18.

There are no changes to report in the Tar Products market, prices remaining as follows:

Pitch, nominal, at 34s. per ton f.o.b.
Creosote, 5¾d.
Refined tar, 3¾d.
Pure toluole, 2s. 4d. to 2s. 5d.; pure benzole, 1s. 7d. to 1s. 8d.; 95/160 solvent naphtha, about 1s. 7d.; and 90/160 pyridine, about 8s.—all per gallon naked at makers' works.

Tar Products in the Provinces.

Jan. 18.

The average prices of gas-works products during the week were: Gas-works tar, 18s. 9d. to 23s. 9d. Pitch—East Coast, 33s. to 34s. f.o.b. West Coast—Manchester, Liverpool, Clyde, 33s. to 34s.* Toluole, naked, North, 1s. 11d. to 2s. Coal tar crude naphtha, in bulk, North, 8d. to 8¼d. Solvent naphtha, naked, North, 1s. 4d. to 1s. 5d. Heavy naphtha, North, 1s. 1½d. to 1s. 2½d. Creosote, *ex* works, in bulk, North, liquid and salty, 4⅞d. to 5⅛d.; low gravity, 4½d. to 4¾d. Heavy oils, in bulk, North, 5d. to 5¼d. Carbolic acid 60's, 2s. 7d. to 2s. 8d. Naphthalene, £18 to £20. Salts, 90s. to 95s., bags included. Anthracene "A" quality, 4½d. to 4⅝d. per minimum 40% purely nominal; "B" quality, unsalable.

* All prices for pitch are now quoted on the basis of f.o.b. In order to arrive at the f.a.s. value at any port it will be necessary to deduct the loading costs and the tolls whatever they may be.

Tar Products in Scotland.

GLASGOW, *Jan.* 16.

Market conditions are steady with good business being conducted in most products.

Crude gas-works tar.—The actual value is 34s. to 35s. per ton *ex* works in bulk.

Pitch remains dull at 30s. to 32s. 6d. per ton f.o.b. Glasgow for export and 30s. per ton *ex* works in bulk for home trade.

Refined tar is still quoted at 3d. per gallon f.o.r. for export, and 3¾d. per gallon *ex* work in buyers' packages for home trade.

Creosote oil.—Supplies are not at all plentiful and prices show an increase as follows: Specification oil, 5¼d. to 5½d. per gallon; low gravity, 5¼d. to 5½d. per gallon; neutral oil, 5d. to 5¼d. per gallon; all *ex* works in bulk.

Cresylic acid.—Available supplies are small and prices are firm as under: Pale, 97/99%, 2s. 7d. to 2s. 9d. per gallon; dark, 97/99%, 2s. 4d. to 2s. 6d. per gallon; and pale, 99/100%, 2s. 11d. to 3s. 2d. per gallon; all *ex* works in buyers' packages.

Crude naphtha.—Supplies are slow in coming forward and value is unchanged at 5½d. to 6d. per gallon *ex* works in bulk, according to quality and district.

Solvent naphtha.—90/160 grade is valued at 1s. 3d. to 1s. 4d. per gallon, and 90/190 heavy naphtha at 10½d. to 11½d. per gallon.

Motor benzole has increased in sympathy with petrol to 1s. 3d. to 1s. 4d. per gallon.

Pyridine.—Prices are nominal at 6s. to 6s. 6d. per gallon for 90/160 grade, and 7s. to 7s. 6d. per gallon for 90/140 grade.

Benzole Prices.

These are considered to be the market prices for benzole at the present time:

	s.	d.		s.	d.			
Crude benzole . . .	0	8½	to	0	9	per gallon	at	works
Motor ,, . . .	1	2	,,	1	2½	,,	,,	,,
90% ,, . . .	1	3	,,	1	3½	,,	,,	,,
Pure ,, . . .	1	7	,,	1	7½	,,	,,	,,

Overseas Opportunities

Palestine.

A firm of agents in Jerusalem wish to represent United Kingdom manufacturers of black and galvanized gas and water pipes. (Ref. No. 636.)

Contracts Advertised To-Day

Telpher Track.

Southport Gas Department. [p. 167.]

Gas Undertakings' Results

Newport (Salop).

The accounts of the Gas Undertaking of the Newport (Salop) Urban Council for the year ended March 31, 1936, show a gross profit of £1,685, compared with £937 for the previous year. After providing for all payments there was a net profit of £216, of which £150 was put to a reserve fund and the remainder carried forward. In moving the adoption of the report, Mr. W. Wheat (Chairman) said he thought from the figures the ratepayers would see what a valuable asset the Council had in the works.

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THE **DUMBARTON** CORPORATION GAS DEPT. (2ND ORDER)
THE **BELFAST** CORPORATION GAS DEPT. (6TH ORDER)
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STOCK AND SHARE LIST

Official Quotations on the London Stock Exchange

Issue. £	Stock or Share	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Jan. 15.	Rise or Fall on Week.	Transactions, Lowest and Highest Prices During the Week.
1,767,439	Stk.	Sept. 7	7⅞	8	Alliance & Dublin Ord. ...	169—174	...	176
374,000	,,	Dec. 14	4	4	Do. 4 p.c. Deb. ...	92—97	...	...
557,655	,,	Aug. 10	7	7	Barnet Ord. 7 p.c.	168—173	...	...
300,000	1	Oct. 5	1 9⅛	1 4½	Bombay, Ltd.	26/—28/-	...	27/—27/6
179,305	Stk.	Aug. 10	9½	9½	Bournemouth sliding scale ...	220—230	...	...
590,407	,,	,,	7	7	Do. 7 p.c. max. ...	171—176	...	174
493,960	,,	,,	6	6	Do. 6 p.c. Pref. ...	148—153	...	...
50,000	,,	Dec. 14	3	3	Do. 3 p.c. Deb. ...	85—90	...	...
262,025	,,	,,	4	4	Do. 4 p.c. Deb. ...	104—109	...	...
335,000	,,	,,	5	5	Do. 5 p.c. Deb. ...	123—128	...	127
357,900	,,	Aug. 10	7½	7½	Brighton, &c., 6 p.c. Con. ...	168—173	...	172
649,955	,,	,,	6½	6½	Do. 5 p.c. Con. ...	154—159	...	156½
205,500	,,	,,	6	6	Do. 6 p.c. 'B' Pref.	145—150	...	...
855,000	,,	Oct. 5	8	7	British Ord.	157—162	...	159—159½
100,000	,,	Dec. 14	7	7	Do. 7 p.c. Pref.	148—153	...	...
350,000	,,	,,	5½	5½	Do. 5½ p.c. 'B' Cum. Pref.	112—117	...	115¼—115¾
120,000	,,	,,	4	4	Do. 4 p.c. Red. Deb. ...	95—100	...	...
450,000	,,	,,	5	5	Do. 5 p.c. Red. Deb. ...	109—114	...	...
200,000	,,	,,	3½	3½	Do. 3½ p.c. Red. Deb. ...	99—102	...	...
100,000	10	22 May '33	6	4	Cape Town, Ltd.	1—3	...	...
100,000	10	6 Nov. '33	4½	4½	Do. 4½ p.c. Pref. ...	1—3	...	...
150,000	Stk.	Jan. 4	4½	4½	Do. 4½ p.c. Deb. ...	80—85*	...	...
626,860	,,	July 20	6	6	Cardiff Con. Ord.	128—133	...	...
237,860	,,	Dec. 14	5	5	Do. 5 p.c. Red. Deb.	108—113	...	...
98,936	1	Oct. 19	2/-	2/-	Colombo Ord.	1⅛—1⅝	...	...
24,510	1	,,	1 4½	1 4½	Do. 7 p.c. Pref. ...	23/6—25/6	...	...
739,453	1	Oct. 5	-/11·48	-/11·48	Colonial Gas Assn. Ltd. Ord.	17/6—19/6	...	...
296,144	1	,,	1·3·30	1·3·30	Do. 8 p.c. Pref.	21/—23/-	...	...
1,775,005	Stk.	Aug. 10	5	5	Commercial Ord.	93—98	...	94—95
620,000	,,	Nov. 30	3	3	Do. 3 p.c. Deb. ...	82—87	...	82
286,344	,,	Aug. 10	5	5	Do. 5 p.c. Deb. ...	122—127	...	125½—126½
807,560	,,	Aug. 10	7	7	Croydon sliding scale ...	158—163	...	161½—163
644,590	,,	,,	5	5	Do. max. div.	115—120	...	117½
620,385	,,	Dec. 14	5	5	Do. 5 p.c. Deb.... ...	123—128	...	...
239,000	,,	Aug. 10	5	5	East Hull Ord. 5 p.c.... ...	109—113	+1½	112
184,555	,,	Aug. 10	6	6	East Surrey Ord. 5.p.c.	128—133	...	...
176,211	,,	Dec. 14	5	5	Do. 5 p.c. Deb. ...	121—126	...	...
250,000	1	Nov. 16	6	4	Gas Consolidation Ord. ...	20/6—22/6	...	...
250,000	1	,,	4	4	Do. 4 p.c. Red. Cum. Pref.	19/—21/-	...	...
19,255,284	Stk.	Aug. 10	5½	5½	Gas Light & Coke 4 p.c. Ord.	26 3—27 3a	...	26/7½—27/-
2,600,000	,,	,,	3½	3½	Do. 3½ p.c. max.	89—92	...	89½—90
4,477,106	,,	,,	4	4	Do. 4 p.c. Con. Pref....	104—108	...	105—106
8,602,497	,,	Nov. 30	3	3	Do. 3 p.c. Con. Deb....	83—86	...	84½—86
3,642,770	,,	,,	5	5	Do. 5 p.c. Red. Deb....	115—118	...	...
3,500,000	,,	,,	4½	4½	Do. 4½ p.c. Red. Deb....	114—117	...	114½—115
700,000	,,	Sept. 7	...	25/5⅜	Do. 3½ p.c. Red. Deb....	102—104	...	104
270,466	,,	Aug. 24	6	6	Harrogate New Cons. ...	128—133	...	...
213,200	,,	Aug. 10	6	6	Hornsey Con. 3½ p.c. ...	133—138	...	...
5,600,000	,,	Nov. 2	12	8	Imperial Continental Cap. ...	155—160	+8	149½—158
223,130	,,	July 20	3½	3½	Do. 3½ p.c. Red. Debs....	92—97	...	...
285,242	,,	Aug. 24	8½	8½	Lea Bridge 5 p.c. Ord.	186—191	...	188½
11,751	,,	,,	10	8	Maidstone Gas 5 p.c. Cap. Stk.	190—200	...	...
63,480	,,	Dec. 14	3	3	Do. 3 p.c.Prp.Db.Sk.	79—84	...	...
75,000	,,	Nov. 30	†10	†10	Malta & Mediterranean ...	185—195	...	...
392,000	—	Oct. 1	5½	5½	Metropolitan (of Melbourne) 5½ p.c. Red. Deb. ...	100—105	...	...
231,978	Stk.	Aug. 24	5	5	M.S. Utility 'C' Cons. ...	111—116	+1	114½
818,657	,,	,,	4	4	Do. 4 p.c. Cons. Pref.	102—107	...	...
360,075	,,	Dec. 14	4	4	Do. 4 p.c. Deb. ...	103—108	...	...
148,955	,,	,,	5	†5	Do. 5 p.c. Deb. ...	121—126	...	...
125,000	—	Jan. 4	3½	3½	Do. 3½ p.c. Rd.Rg.Bds.	97—100*	...	...
675,000	Stk.	Nov. 16	†6	†6	Montevideo, Ltd.	80—85	...	...
225,000	,,	Aug. 10	7½	7½	North Middlesex 6 p.c. Con.	170—175	...	172
396,160	,,	Aug. 10	5	5	Northampton 5 p.c. max. ...	110—115	...	...
300,000	,,	Nov. 2	†7	†9	Oriental, Ltd....	168—173	...	...
416,617	,,	Dec. 14	8	8	Plymouth & Stonehouse 5 p.c.	165—170	...	167
504,416	,,	Aug. 10	8½	8½	Portsmouth & Gosport Cons.	178—183	...	182½
241,446	,,	,,	5	5	Do. 5 p.c. max. ...	114—119	...	...
73,350	,,	,,	...	5	Do. 5 p.c. Pref. ...	118—123	...	...
363,470	1	Sept. 21	1/-	1/-	Severn Val. Gas Cor. Ld. Ord.	21/—23/-	-/6	22/6
454,510	1	,,	-/10½	-/10½	,, ,, 4½ p.c. Cum. Pref.	21/—23/-	...	...
133,201	Stk.	Aug. 24	5	8½	Shrewsbury 5 p.c. Ord. ...	145—150	...	...
90,000	10	June 8	13½	14	South African...	4—5	...	...
1,152,635	1	Sept. 7	1 2½	1 2½	South East'n Gas. Cn.Ld. Ord.	27/—29/-	...	27/—28/-
845,511	1	,,	-/10½	-/10⅝	Do. 4½ p.c. Red. Cum. Pref.	21/—23/-	...	21/—21/9
200,000	1	,,	4	4	Do. 4 p.c. Cum. Pref. ...	20 6—21/6	...	...
150,000	Stk.	Aug. 10	...	3½	Do. 3½ p.c. Red. Deb. ...	100—102	...	...
6,709,895	,,	Aug. 10	6½	5	South Met. Ord.	118—121	+1½	118—120½
1,135,812	,,	,,	6	6	Do. 6 p.c. Irred. Pf. ...	145—150	...	146
850,000	,,	,,	4	4	Do. 4 p.c. Irred. Pf. ...	104—107	...	105
1,895,445	,,	Dec. 14	3	3	Do. 3 p.c. Deb. ...	83—86	...	83—84½
1,000,000	,,	Jan. 4	5	5	Do. 5 p.c. Red. Deb....	113—116*	...	...
1,543,795	,,	Aug. 10	6	6	South Suburban Ord. 5 p.c....	130—135	...	132—134
512,825	,,	,,	5	5	Do. 5 p.c. Pref....	121—126	...	124—126
500,000	,,	,,	4	4	Do. 4 p.c. Pref....	102—107	...	...
888,587	,,	Dec. 14	5	5	Do. 5 p.c. Deb....	122—127	...	122—125
250,000	,,	,,	4	4	Do. 4 p.c. Deb....	103—108	...	...
427,859	1	Nov. 16	1 2½	9½	S. Western Gas & Water Ord.	21/—23/-	...	21/6—22/6
160,523	1	Oct. 19	-/10½	-/10½	Do. 4½% Red. Cum. Pref.	20 6—22 6	...	22/-
110,000	Stk.	Dec. 14	4	4	Do. 4% Red. Deb. ...	100—105	...	...
647,740	,,	Aug. 10	5½	5	Southampton Ord. 5 p.c. ...	113—118	...	...
121,275	,,	Jan. 4	4	4	Do. 4 p.c. Deb.	100—105*	...	...
350,000	,,	Aug. 10	5½	5½	Swansea 5½ p.c. Red. Pref. ...	112—117	...	...
106,000	,,	Jan. 4	6½	6½	Do. 6½ p.c. Red. Deb. ...	98—101*	...	...
94,000	,,	,,	3½	3½	Do. 3½ p.c. Red. Deb. ...	95—100*	...	...
1,076,490	,,	Aug. 10	6½	6½	Tottenham and District Ord.	152—157	...	154½—155
409,835	,,	,,	5½	5½	Do. 5½ p.c. Pref....	130—135	...	131½
62,235	,,	,,	5	5	Do. 5 p.c. Pref. ...	120—125	...	...
371,850	,,	Nov. 30	4	4	Do. 4 p.c. Deb. ...	102—107	...	104—105½
369,774	,,	Aug. 10	7	7	Uxbridge, &c., 5 p.c. ...	165—170	...	...
108,330	,,	,,	5	5	Do. 5 p.c. Pref. ...	120—125	...	...
1,340,521	,,	Aug. 10	7	7	Wandsworth Consolidated ...	159—164	...	162—162½
1,371,373	,,	,,	5	5	Do. 5 p.c. Pref ...	122—127	...	124½—126
500,000	,,	,,	...	...	Do. 4 p.c. Pref. ...	104½—107½	...	...
1,317,964	,,	Dec. 14	5	5	Do. 5 p.c. Deb. ...	125—130	...	...
338,300	,,	,,	4	4	Do. 4 p.c. Deb. ...	102—107	...	...
499,735	,,	Aug. 10	7½	7	Watford and St. Albans Ord.	157—162	...	...
200,000	,,	,,	5	5	Do. 5 p.c. Pref. ...	120—125	...	125
200,000	,,	,,	5½	5½	Do. 5½ p.c. Pref. ...	131—136	...	...
200,000	,,	Dec. 14	4	4	Do. 4 p.c. Red. Deb.	100—105	...	...
100,000	,,	,,	3½	3½	Do. 3½ p.c. Red.Deb.	99—102	...	...

a.—The quotaion is per £1 of Stock. * Ex div. † Paid free of income-tax. ‡ For year. § Actual.

Stock and Share List continued overleaf.

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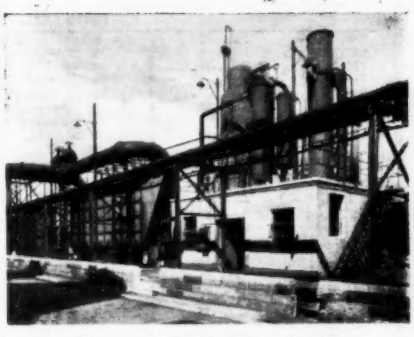

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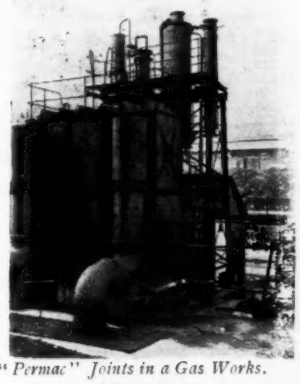

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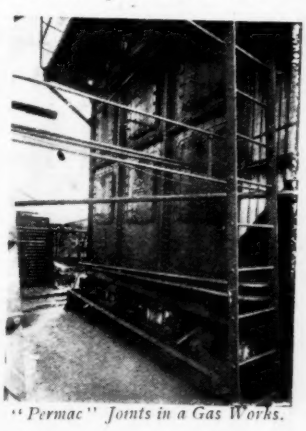

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STOCK AND SHARE LIST—Cont.

Stocks Officially Quoted on Provincial Exchanges

Issue. £	Stock or Share	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations. Jan. 15.	Rise or Fall on Week.	Transactions, Lowest and Highest During the Week.
BRISTOL EXCHANGE.								
347,756	Stk.	July 20	6	5	Bath Cons.	125—127	...	...
1,667,250	,,	July 6	5	5	Bristol, 5 p.c. max.	119—121	...	...
120,420	,,	Dec. 14	4	4	Do. 1st 4 p.c. Deb. ...	101½—103½	...	...
217,870	,,	,,	4	4	Do. 2nd 4 p.c. Deb. ...	101½—103½	...	...
328,790	,,	,,	5	5	Do. 5 p.c. Deb.	122—125	...	...
274,000	,,	Aug. 10	5	5	Newport (Mon.) 5 p.c.max. ...	110—114	...	...
13,200	12	Sept. 7	8½	7	Pontyp'l Gas & W. 10 p.c. 'A'	13½—14½	...	...
13,600	10	,,	6	5	Do. 7 p.c. 'B'	12—12½	...	...
40,000	10	,,	6	5	Do. 7 p.c. 'C'	12—12½	...	...
140,778	Stk.	Aug. 10	5	5	Weston-super-Mare Cons. ...	112—114	...	...
64,338	,,	Dec. 14	4	4	Do. 4 p.c. Deb.	98—101	...	...
33,340	,,	,,	7½	7½	Do. 7½ p.c. Deb.	160—163	...	...
LIVERPOOL EXCHANGE.								
157,150	Stk.	Aug. 10	6½	5	Chester 5 p.c. Ord.	107—112	...	...
92,500	,,	Dec. 14	4½	4	Do. 4 p.c. Pref.	98—102	...	...
32,540	,,	,,	3	3½	Do. 3½ p.c. Deb.... ...	90—95	...	...
41,830	,,	,,	4	4	Do. 4 p.c. Red. Deb. ...	99—103	...	...
2,167,410	,,	Aug. 24	6	6	Liverpool 5 p.c. Ord. ...	132—134	...	...
245,500	,,	Dec. 14	5	5	Do. 5 p.c. Red. Pref. ...	101—106	...	...
306,083	,,	Jan. 4	4	4	Do. 4 p.c. Deb. ...	103—105*	...	...
106,280	,,	July 20	10	10	Preston 'A' 10 p.c.	198—208	...	...
188,219	,,	,,	7	7	Do. 'B' 7 p.c.	137—147	...	...
NEWCASTLE EXCHANGE.								
122,577	Stk.	Aug. 10	8	8	Blyth 5 p.c. Ord.	166—168	+2	...
732,000	,,	Aug. 10	5	5	Hartlepool G. & W. Cn. & New	125—127	...	...
2,061,315	,,	Aug. 10	5½	5	Newcastle & Gateshead Con.	26 —27 -*a*	—/3	...
682,856	,,	,,	4	4	Do. 4 p.c. Pref. ...	104—105	...	...
776,706	,,	Jan. 4	3½	3½	Do. 3½ p.c. Deb. ...	100—102*	...	...
277,285	,,	Nov. 2	5	5	Do. 5 p.c. Deb. '43...	108—109	...	...
209,820	,,	Aug. 10	8½	8½	South Shields Con.	172—174	...	...
299,542	,,	Aug. 10	6	6	Sunderland 6 p.c. max. ...	140—142	...	...
NOTTINGHAM EXCHANGE.								
542,270	Stk.	Aug. 10	10	7	Derby Con.	185—195	...	...
55,000	,,	Dec. 14	4	4	Do. 4 p.c. Deb.	100—105	...	...
84,750	,,	Feb. 17	5	12	Long Eaton 'A' Ord. ...	...	...	...
50,000	,,	,,	4	10	Do. 'B' Ord. ...	...	...	...
20,000	10	Dec. 14	5	5	Do. 5 p.c. Pref. ...	10—12	...	...
80,000	Stk.	,,	5	5	Do. 5 p.c. Deb. ...	117—122	...	...
SHEFFIELD EXCHANGE.								
10,000	Stk.	Aug. 10	10	10	Great Grimsby 'A' Ord. ...	220—230	...	...
6,500	,,	,,	10	10	Do. 'B' Ord. ...	220—230	...	...
79,000	,,	,,	10	10	Do. 'C' Ord. ...	205—215	...	...
1,806,339	,,	Aug. 24	6	6	Sheffield Cons.	146—148	...	...
95,000	,,	July 6	4	4	Do. 4 p.c. Deb.	102—105	...	...

a The quotation is per £1 of Stock.

Supplementary List of Stocks and Shares not Officially Quoted

202,152	Stk.	Nov. 2	5	25/-*a*	Ascot Ord.	118—123	...	...
128,182	,,	Jan. 4	5	5	Do. 5 p.c. Pref.	115—120*	...	...
312,083	1	Nov. 16	5	5	Assd. Gas and Water Ord. ...	21/6—23/6	+-/6	22/9
326,071	1	,,	4½	4½	Do. 4½ p.c. Cum. Pref. ...	21/—23/-	...	22/3
150,000	Stk.	Sept. 21	...	3½	Do. 3½ p.c. Red. Deb. ...	98—101	...	...
17,000	,,	Aug. 24	8	8	Bognor Orig. Ord. 'A' ...	175—185	...	...
62,210	,,	,,	8	8	Do. New Addl. 'A' ...	175—185	...	...
87,160	,,	,,	7	7	Do. New 7 p.c. max. ...	145—150	...	...
37,440	,,	Aug. 10	10	10	Cam. Univ. & Town 10 p.c.max.	205—215	...	...
125,970	,,	,,	7	7	Do. 7 p.c. max.	155—160	...	...
39,025	,,	,,	5	5	Do. 5 p.c. max.	108—113	...	...
65,000	,,	Aug. 10	8½	7½	Eastbourne 'A' 5 p.c. ...	175—180	...	...
198,000	,,	,,	7	6	Do. 'B' 3½ p.c.	142—147	...	...
112,312	,,	,,	5	5	Do. 5 p.c. Pref.	118—123	...	...
130,000	,,	Dec. 14	5	5	Do. 5 p.c. Deb.	122—127	...	...
24,000	30	Aug. 10	8½	8½	Great Yarmouth 8½ p.c. max.	51—56	...	55½
59,400	30	,,	7½	7½	Do. 7½ p.c. max.	42—45	...	...
51,160	Stk.	Dec. 14	5½	5½	Do. 5½ p.c. Deb.	123—128	...	...
152,600	,,	Sept. 7	8	8	Guildford Cons.	200—210	...	...
54,055	,,	,,	5	5	Do. 5 p.c. Pref.	114—119	...	...
68,250	,,	Dec. 14	5	5	Do. 5 p.c. Deb.	120—125	...	...
156,600	,,	Aug. 24	7½	7½	Hampton Court Cons. ...	173—178	...	...
107,960	10	Oct. 5	5½	4	Mid Kent Ord.	8½—9½	...	...
230,940	Stk.	Aug. 10	10	10	Oxford & District Ord. ...	215—225	...	...
47,112	,,	,,	5	5	Do. 5 p.c. Pref.	118—123	...	...
50,000	,,	,,	6	6	Do. 6 p.c. Red. Pref. ...	113—118	...	...
126,193	,,	Nov. 16	7½	7½	Peterborough Ord.	162—172	...	...
64,990	,,	Sept. 7	6½	7½	Redditch Ord.	133—143	...	...
166,850	,,	Aug. 10	9	8	Romford Ord.	160—170	—8	...
60,000	,,	,,	4	4	Do. 4 p.c. Pref.	97—100	...	...
44,000	,,	Sept. 21	5	5	Do. 5 p.c. Deb.	120—125	...	...
10,950	,,	Aug. 24	8	8	Ryde Ord.	165—170	...	...
136,191	,,	Aug. 10	7	5	Scarborough Ord.	126—136	...	...
27,825	,,	Aug. 24	8	8	Shanklin & Ventnor Cons. ...	170—180	...	...
40,643	,,	Sept. 21	7	7	Slough Ord.	156—161	...	...
221,000	,,	Dec. 14	5	5	Do. 5 p.c. Deb.... ...	116—121	...	...
28,872	1	Nov. 2	5½	5½	S. Midland Gas Cpn. Ltd. Ord.	22 —24/-	...	22/6
28,866	1	Sept. 7	4½	4½	Do. 4½ p.c. Red. Cum. Pref.	22/—24/-	...	22/-
137,730	Stk.	Aug. 10	7	7	Southgate & Dist. 7 p.c. max.	151—156	...	...
62,500	,,	,,	5	5	Do. 5 p.c. Pref.	120—125	...	...
117,228	,,	Aug. 10	6	5	Swindon Cons.	110—115	...	113—115
60,425	,,	Dec. 14	5	5	Do. 5 p.c. Deb.	118—123	...	...
64,380	,,	Dec. 14	5	5	Torquay and Paignton 5 p.c. Pf.	115—120	...	...
750,000	1	Oct. 5	5·52d.*a*	4	Utd. Kingdom Gas Cpn. Ord.	21/6—22/6	...	21/9—22/1½
606,270	1	,,	2½	2½	Do. 4½ p.c. Prefd. Ord. ...	20 —22/-	...	20/9—21/3
936,338	1	Nov. 16	4½	4½	Do. 4½ p.c. Cum. Pref. ...	21/6—23/6	...	21/9—22/4½
600,000	Stk.	Sept. 21	3½	3½	Do. 3½ p.c. Red. Deb. ...	99—102	...	101
130,000	,,	Aug. 10	8	5	Wakefield Ord.	140—145	...	...
81,650	,,	,,	5	5	Do. 5 p.c. max.	105—110	...	...
82,000	,,	July 20	6	6	Weymouth Ord.	105—110	...	...
98,384	,,	Aug. 10	6	6	Wolverhampton 6 p.c. Pref....	127—132	...	...
160,000	,,	Dec. 14	5½	5½	Do. 5½ p.c. Rd. Db	110—115	...	...
370,000	,,	July 20	6	4	York Cons.	110—120	...	...
90,000	,,	Dec. 14	5	5	Do. 5 p.c. Red. Deb. ...	108—113	...	...
133,640	,,	July 20	6½	6½	Yorktown (Cam.) 5 p.c ons.	140—150	...	...
120,000	,,	,,	5	5	Do. 5 p.c. Pref.	123—128	...	...
35,000	,,	Dec. 14	5½	5½	Do. 5½ p.c. Deb.... ...	128—133	...	...

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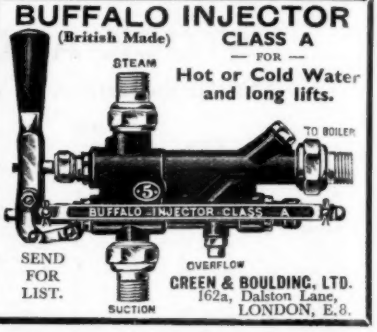

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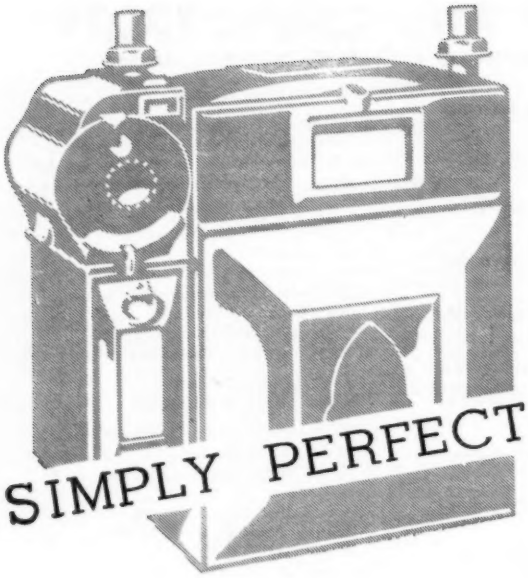

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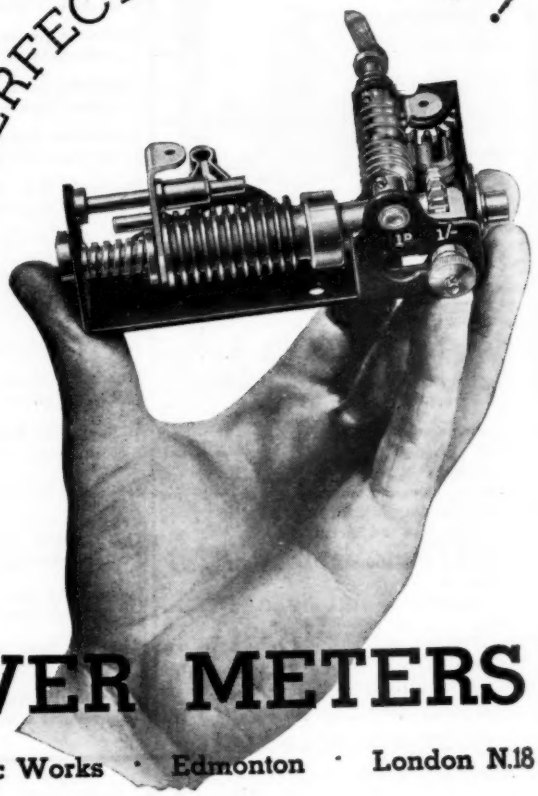

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